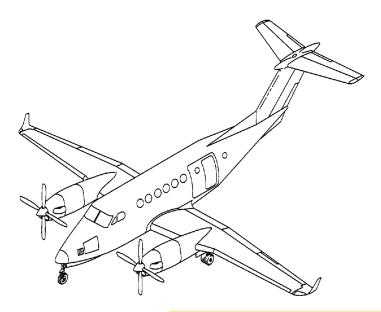




NATOPS FLIGHT MANUAL NAVY MODEL UC-12W AIRCRAFT

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THE AIRCRAFT



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MEMORANDUM

From: Naval Air Systems Command

AIR 4.1.1.3, C-12 APMSE

To: NATEC Technical Data Management Department, FOIA Office

William L. Barnes

Subj: FREEDOM OF INFORMATION ACT (FOIA) REQUEST FOR NAVAIR

NATOPS FLIGHT MANUAL NAVY MODEL UC-12W, A1-C12WA-NFM-000,

DTD 15APR2020

Ref (a) NATEC CASE DON-NAVY-2021-003276, 09 February 2021

1. Reference (a) requested a review of the subject requested document for public disclosure, and determination if the document, in portion or as a whole, is subject to export control.

2. After due consideration, the C-12 aircraft APMSE, of the Controlling DoD/Program Office (PMA-207), concludes that there is no reason that the requested document should be withheld from public disclosure. This document, a NATOPS Flight Manual for the US Marine Corps UC-12W aircraft, contains no classified or otherwise sensitive data or information that would warrant its being withheld from public disclosure.

3. Controlling DoD/Program Office Point of Contact (POC) is Mr. Doy Sharpe, (301) 247-1737.

W.D. SHARPE

C-12 APMSE



DEPARTMENT OF THE NAVY

NAVAL AIR SYSTEMS COMMAND RADM WILLIAM A. MOFFETT BUILDING 47123 BUSE ROAD, BLDG 2272 PATUXENT RIVER, MARYLAND 20670-1547

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Approved

JOHN S. LEMMON

Rear Admiral, United States Navy

By direction of

Commander, Naval Air Systems Command

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RECORD OF CHANGES

Date of Change	Remarks/Purpose and Affected Chapter/Section/Pages
15 April 2020	 Front Matter Updates. LOEPC and ROC. Deletion of IC Summary page and Summary of Applicable Technical Directives page. Updated Figure 2-6. Updated Chapter 20 figures and paragraphs 20.1 thru 20.3. Updated Appendix A title, figures, and paragraphs.
15 December 2018	 eNATOPS conversion update to include the following: Miscellaneous Admin and Front Matter Updates. Cover, Letter of Promulgation, Contents, LOI, LOAA, and Preface. Deletion of LOEP Page. Updated Chapter 1 title and paragraphs 1.1, 1.3 thru 1.6. FCF Updates. Paragraphs 9.3 Note and 9.11 step 17. a. (2). AIRS 2017-265.
1 August 2016	Revision

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BIBLIOGRAPHY

- 1. Super King Air 350ER, 350ERi and 350CER (Models B300 and B300C), Heavy Weight Aircraft with Extended Fuel Capabilities, Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, P/N 130-590031-245A2, Dated December 2009.
- 2. Super King Air 350ER, 350ERi and 350CER (Models B300 and B300C), Heavy Weight Aircraft with Extended Fuel Capabilities, Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, Temporary Change 4, P/N 130-590031-245TC4, Dated February 2011.
- 3. Super King Air 350ER, 350ERi and 350CER (Models B300 and B300C), Heavy Weight Aircraft with Extended Fuel Capabilities, Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, Temporary Change 5, P/N 130-590031-245TC5, Dated February 2011.
- 4. Hawker Beechcraft Corporation Super King Air 350, 350i, 350C, 350ER, 350ERi, and 350CER (Models B300 and B300C) Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplement for the Emergency Crash Axe and/or Fairchild FA2100 Cockpit Voice Recorder and/or Artex 110-406 or Artex C406-2 Emergency Locator Transmitter (ELT) System. P/N 130-590031-145, March 2010. Note: Only the Fairchild FA2100 Cockpit Voice Recorder and the Artex C406-2 Emergency Locator Transmitter (ELT) System are installed.
- 5. Super King Air 350ER, 350ERi and 350CER (Models B300 and B300C), Heavy Weight Aircraft with Extended Fuel Capabilities, Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplement for the Mode S Enhanced Surveillance Transponder, P/N 130-590031-241, Dated August 2008.
- 6. FAA Approved Supplement to the Hawker Beechcraft Models B300 and B300C Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, Operations in Reduced Vertical Seperations Minimum (RVSM) Airspace. Supplement No. AMI-AFMS-KAIR-0722, Original Issue, May 25, 2010. STC SA01798SE-D.
- 7. Hawker Beechcraft Services, Supplement to Pilots Operating Handbook and FAA Approved Airplane Flight Manual for Modular Airborne Data Recording Acquisition System (MADRAS) in Pro Line-Equipped Hawker Beechcraft Corporation Model B200/B200C/B200GT/B200CGT/B300/B300C King Air Aircraft. Document No. RAS060500132, Revision 2.0, March 26, 2009. STC SA10478SC.
- 8. Flight Manual Supplement DAAS-T-250-5 for Part 23 Aircraft, Pratt and Whitney Engine Services, Inc., Digital Aircraft Data Acquisition System (ADAS), Rev. No. D, May 14, 2010. STC SA00295BO.
- FAA Approved Airplane Flight Manual Supplement for Hawker Beechcraft Corp. B300 and B300C Aircraft with Dual FMS-3000 Flight Management System with 3rd Trimble GPS, AN/ARN-153(v) TCN-500 TACAN, AN/APX-119 IFF Transponder, AN/ARC-210 VHF/UHF Comm Radio, 3rd Crew Audio, WX-1000E Stormscope, and ASE Equipment. P/N 130-590031-371, May 25, 2010. STC 00047MC.
- 10. Hawker Beechcraft Corporation Production Flight Test Procedure Quality Assurance Instructions Model B300/B300C, Including Heavy Weight Aircraft with or without Extended Range Tanks, Revision 8, dated February 15, 2010.
- 11. Super King Air 350ER (Model B300) Pilot's Operating Handbook and Manufacturer Approved Airplane Flight Manual Supplement for Special Mission Aircraft Operating on Wet or Contaminated Runways, P/N 130-590031-369, Dated February 2010.
- 12. Aerospace Resources FAA Approved Aircraft Flight Manual Supplement for Cargo Equipment Installation, Hawker Beechcraft B300 and B300C Document Number 20-0350-1FMS Revision 1.

13. FAA Approved Airplane Flight Manual Supplement for The Engine Aural Warning Tone For The Rockwell Collins Pro Line 21 Avionics System On The Beechcraft Model B300, B300C Series Aircraft, Document No. 2-112347-804, Rev. IR, STC ST00098MC.

GLOSSARY

General Airspeed Terminology

- **CAS.** Calibrated Airspeed is the indicated airspeed of an airplane corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
- **GS.** *Ground Speed* is the speed of an airplane relative to the ground.
- **IAS.** *Indicated Airspeed* is the speed of an airplane as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
- **KCAS.** *Calibrated Airspeed* expressed in knots.
- **KIAS.** *Indicated Airspeed* expressed in knots.
- **M.** *Mach Number* is the ratio of true airspeed to the speed of sound.
- **TAS.** *True Airspeed* is the airspeed of an airplane relative to undisturbed air, which is the CAS corrected for altitude, temperature, and compressibility.
- V₁. Take-off Decision Speed.
- **V₂.** Take-off Safety Speed is the speed at 35 feet AGL, assuming an engine failure at V1.
- **V35.** Take-Off Safety Speed at 35 feet AGL with both engines operating.
- **VA.** *Maneuvering Speed* is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
- **VF.** Design Flap Speed is the highest speed permissible at which wing flaps may be actuated.
- **VFE.** Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
- **VLE.** *Maximum Landing Gear Extended Speed* is the maximum speed at which an airplane can be safely flown with the landing gear extended.
- **VLO.** Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

- VMCA. Air Minimum Control Speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. The airplane certification conditions include one engine becoming inoperative with autofeather armed, a 5-degree bank towards the operative engine, take-off power on operative engine, landing gear up, flaps in the take-off position, and most rearward C.G. For some conditions of weight and altitude, stall can be encountered at speeds above VMCA as established by the certification procedure described above, in which event stall speed must be regarded as the limit of effective directional control.
- **VMO/MMO.** Maximum Operating Limit Speed is the speed limit that may not be deliberately exceeded in normal flight operations. VMO is expressed in knots and MMO in Mach Number.
- **VR.** Rotation Speed.
- **VREF.** Reference Landing Approach Speed with the landing gear and flaps down.
- **VS.** *Stalling Speed* or the minimum steady flight speed at which the airplane is controllable.
- **VS1.** Stalling Speed or the minimum steady flight speed at which the airplane is controllable in a specific configuration.
- **VSO.** *Stalling Speed* or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
- **VSSE.** *Intentional One-Engine-Inoperative Speed* is a speed above both VMCA and stall speed, selected to provide a margin of lateral and directional control when one engine is suddenly rendered inoperative.
- **VX.** Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
- **VXSE.** One Engine Inoperative Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible horizontal distance with one engine inoperative.
- **VY.** Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

VYSE. One-Engine-Inoperative Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time with one engine inoperative.

Meteorological Terminology

- **Altimeter Setting.** Barometric Pressure corrected to sea level.
- **Indicated Pressure Altitude.** The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).
- **IOAT.** *Indicated Outside Air Temperature* is the temperature value read from an indicator.
- **ISA.** *International Standard Atmosphere* in which:
 - (1) The air is a dry perfect gas;
 - (2) The temperature at sea level is 15° Celsius (59° Fahrenheit);
 - (3) The pressure at sea level is 29.92 inches of mercury (1013.2 millibars);
 - (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5° Celsius (-69.7° Fahrenheit) is -0.00198° Celsius (0.003566° Fahrenheit) per foot and zero above that altitude.
- **OAT.** Outside Air Temperature is the free air static temperature obtained either from the temperature indicator (IOAT) adjusted for compressibility effects, or from ground meteorological sources.
- **Pressure Altitude.** Altitude measured from standard sea-level pressure (29.92 in. Hg (1013.2 millibars)) by a pressure (barometric) altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero. Position errors may be obtained from the Altimeter Correction graphs.
- **Station Pressure.** Actual atmospheric pressure at field elevation.
- **Temperature Compressibility Effects.** An error in the indication of temperature caused by airflow over the temperature probe. The error varies, depending on altitude and airspeed.
- **Wind.** The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

Power Terminology

- **Beta Range.** The region of the Power Lever control which is aft of the Idle Gate and forward of reversing range where blade pitch angle can be changed without a change of gas generator rpm.
- **Cruise Climb Power.** Is the maximum power approved for cruise climb. These powers are torque or temperature (ITT) limited.
- **Cycle.** A "normal" or "full" cycle includes the following: Engine Start Idle Takeoff Flight Landing -Idle Shutdown.
- **High Idle.** Obtained by placing the Condition Lever in the High Idle Position. This limits the power operation to a minimum of 70% of N1 rpm.
- **Low Idle.** Obtained by placing the Condition Lever in the Low Idle position. This limits the power operation to a minimum of 62% of N1 rpm.
- **Maximum Continuous Power.** Is the highest power rating not limited by time. Use of this rating is at the discretion of the pilot.
- **Maximum Cruise Power.** Is the highest power rating for cruise, and is not time limited.
- **Propeller Ground Fine.** Propeller ground fine operation is used to provide deceleration on the ground during landing and accelerate-stop conditions by taking advantage of the maximum available propeller drag without creating negative thrust.
- **Reverse.** Reverse thrust is obtained by lifting the Power Levers and moving them aft of the Beta and Ground Fine range.
- **SHP.** Shaft Horsepower.
- **Static Take-off Power.** Is the static power which must be available for takeoff without exceeding the engine limitations.
- **Take-off Power.** Is the maximum power rating. Use of this rating should be limited to normal take-off operations and other operations at the discretion of the pilot.

Control and Instrument Terminology

Condition Lever (Fuel Shut-off Lever). The fuel shut-off lever actuates a valve in the fuel control unit which controls the flow of fuel at the fuel control outlet and regulates the idle range from Low to High Idle.

- **ITT** (Interstage Turbine Temperature). Eight probes wired in parallel indicate the temperature between the compressor and power turbines.
- **N1 Tachometer (Gas Generator RPM).** The tachometer registers the rpm of the gas generator with 100% representing a gas generator speed of 37,500 rpm.
- **Power Lever (Gas Generator N1 RPM).** This lever serves to modulate engine power from full reverse thrust to take-off. The position for idle represents the lowest recommended level of power for flight operation.
- **Propeller Control Lever (N2 RPM).** This lever is used to control the rpm setting of the propeller governor. Movement of the lever results in an increase or decrease in propeller rpm. Propeller feathering is the result of lever movement beyond the detents at the low rpm (high pitch) end of the lever travel.
- **Propeller Governor.** The propeller governor senses changes in rpm and hydraulically changes propeller blade angle to compensate for the changes in rpm. Constant propeller rpm is thereby maintained at the selected rpm setting.
- **Torquemeter.** The torquemeter system indicates the shaft output torque. Instrument readout is in percent.

Graph and Tabular Terminology

AGL. Above Ground Level.

- **Best Angle-of-Climb.** The best angle-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance with gear and flaps up.
- **Best Rate-of-Climb.** The best rate-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible time with gear and flaps up.
- **Climb Gradient.** The ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
- **Demonstrated Crosswind.** The maximum 90-degree crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification. The value shown is not limiting.
- **Landing Distance.** The distance from a point 50 feet above the runway surface to the point at which the airplane would come to a full stop utilizing the technique in Section 5, PERFORMANCE. These distances do not

include landing factors which may be required by the operating regulations for destination or alternate airports.

MEA. Minimum Enroute Altitude.

- **Net Gradient of Climb.** The gradient of climb with the flaps in the take-off position, and the landing gear retracted. "Net" indicates that the actual gradients of climb have been reduced by a regulatory increment to allow for turbulence and pilot technique. The Net Gradient of Climb graphs are constructed so that the value(s) obtained using the airport pressure altitude and outside air temperature will be the average gradient from 35 ft above the runway up to 1,500 ft above the runway.
- **Route Segment.** A part of a route. Each end of that part is identified by:
 - (1) a geographic location; or
 - (2) a point at which a definite radio fix can be established.
- **Take-off Field Length (TOFL).** The minimum runway length required for departure. This distance is the longest of:
 - (1) The distance to accelerate and recognize an engine failure at V1, accelerate to and rotate at VR, then climb and accelerate in order to achieve V2 at 35 feet above the runway, OR
 - (2) The distance to accelerate and recognize an engine failure at V1 and bring the airplane to a stop, OR
 - (3) The all-engine-operating distance to accelerate to and rotate at VR, then climb and accelerate in order to achieve V35 at 35 feet above the runway, increased by 15%.
- **Take-off Flight Path.** The minimum gradient of climb required to clear obstacles in excess of 35 feet, measured horizontally from reference zero and vertically at the altitude above the runway. Reference zero is the point where the airplane has reached 35 feet above the runway as determined from the Take-off Field Length graphs.

Weight and Balance Terminology

- **Approved Loading Envelope.** Those combinations of airplane weight and center of gravity which define the limits beyond which, loading is not approved.
- **Arm.** The distance from the center of gravity of an object to a line about which moments are to be computed.
- **Basic Empty Weight.** The weight of an empty airplane including full engine oil and unusable fuel. This equals empty weight plus the weight of unusable fuel, and the weight of all the engine oil required to fill the lines and tanks. Basic Empty Weight is the basic configuration from which loading data is determined.

- **Center of Gravity.** A point at which the weight of an object may be considered concentrated for weight and balance purposes.
- **CG Limits.** The extreme center of gravity locations within which the airplane must be operated at a given weight.
- **Datum.** A vertical plane perpendicular to the airplane longitudinal axis from which fore and aft (usually aft) measurements are made for weight and balance purposes.
- **Empty Weight.** The weight of an empty airplane before any oil or fuel has been added. This includes all permanently installed equipment, fixed ballast, full hydraulic fluid, full chemical toilet fluid, and all other operating fluids full, except that the engines, tanks, and lines do not contain any engine oil or fuel.
- **Engine Oil.** That portion of the engine oil which can be drained from the engine.
- **Jack Point.** Points on the airplane identified by the manufacturer as suitable for supporting the airplane for weighing or other purposes.
- **Landing Weight.** The weight of the airplane at landing touchdown.
- **Leveling Points.** Those points which are used during the weighing process to level the airplane.

- **Maximum Weight.** The largest weight allowed by design, structural, performance or other limitations.
- **Moment.** A measure of the rotational tendency of a weight, about a specified line, mathematically equal to the product of the weight and the arm.
- Payload. Weight of occupants, cargo and baggage.
- **Ramp Weight.** The airplane weight at engine start assuming all loading is completed.
- **Station.** The longitudinal distance from some point to the zero datum or zero fuselage station.
- **Take-off Weight.** The weight of the airplane at lift-off from the runway.
- **Tare.** The weight which may be indicated by a set of scales before any load is applied.
- **Unusable Fuel.** The fuel remaining after consumption of usable fuel.
- **Usable Fuel.** That portion of the total fuel which is available for consumption as determined in accordance with applicable regulatory standards.
- **Useful Load.** The difference between the airplane ramp weight and the basic empty weight.
- **Zero Fuel Weight.** The airplane ramp weight minus the weight of usable fuel on board.

Ε

LIST OF ABBREVIATIONS AND ACRONYMS

Α

Attitude heading computer.

C

Control display unit.

Change recommendation.

Data base unit.

CDU.

CR.

DBU.

ACSS. Aviation communication and surveillance system. EDC. Engine data concentrator unit. ADC. Air data computer. EFIS. Electronic flight instrument system. ADS. Air data system. EIS. Engine indication system. AFD. Adaptive flight display. ESIS. Electronic standby instrument system. AHC. Attitude heading reference system. F

AHRS.

FGC. Flight guidance computer. AHS. Attitude heading system.

FGP. Flight guidance panel. ASE. Aircraft survivability equipment.

FGS. Flight guidance system.

FMC. Flight management computer.

CCP. Cursor control panel. FMS. Flight management system.

CD. Compact disc. G

GPS. Global positioning system. CMS. Cabin management system.

GPWS. Ground proximity warning system.

CPA. Collision prediction and alerting.

HFI. Hostile fire indication.

D

IAPS. Integrated avionics processing system. DCP. Display control panel.

IEC. Interstate electronics corporation. DCU. Data concentrator unit.

IFIS. Integrated flight information system. DVD. Digital versatile disk or Digital video disk.

45

ISS. Impending stall speed.

Н

I

PA.

RA.

Public address.

L S

LSC. Low speed cue. **SAT.** Static air temperature.

Т

٧

MAC. Mean aerodynamic chord. **TA.** Terrain awareness or Traffic advisory.

MFD. Multi-function display. **TAWS+.** Terrain awareness and warning system plus.

MWS. Missile warning system.TCAS. Traffic collision avoidance system.

P TERR. Terrain.

M

PC. Personal computer.

USB. Universal serial port. **PFD.** Primary flight display.

VGA. Video graphics array.

RTU. Radio tuning unit.

R

Radio altimeter or Resolution advisory.

PREFACE

SCOPE

Naval Air Training and Operating Procedures Standardization (NATOPS) products have been developed to improve aviation safety and readiness throughout the Navy and Marine Corps. They are prepared under the authority of the Chief of Naval Operations and issued by Commander, Naval Air Systems Command to support naval aircraft flight operations. NATOPS flight manuals (NFMs) contain flight clearance information, operating procedures and restrictions necessary for flight crews to effectively operate their aircraft. They provide the best available T/M/S aircraft information and operating instructions for most circumstances. However, no manual can address every situation completely or be a substitute for sound judgment. Operational situations may require modification of the procedures contained therein. Read these products thoroughly. As an aircrew member, it is your responsibility to have a complete knowledge of their contents.

NATOPS PROGRAM INFORMATION

See Chapter 1 for (1) the aircraft permanent flight clearance product set, and (2) aircraft NATOPS program management assignments which include the NATOPS Model Manager Unit, the NATOPS Advisory Group members, and the NATOPS Cognizant Command. Chapter 1 also includes other pertinent NATOPS program information unique to this aircraft.

TYPES OF NATOPS PRODUCTS

Revisions to NATOPS products are produced either in paper form or in electronic (eNATOPS) form where every change to the product is released as a complete product identified by title, NAVAIR number and date. This NATOPS Flight Manual is an eNATOPS (eNFM) product.

eNATOPS PRODUCTS

eProducts are a class of products that are intended to exist only in the electronic environment. This class of products can include derivatives such as ePCL, eFCFCL, etc. While the contents of eProducts remain the same as paper products, eProducts will appear slightly different, and their distribution process is also changed. There will be no changes, interim changes, errata, or pen-and-ink entries released. Changed text and illustrations within an eProduct will be identified by highlighting or change bars in the page margin. NATOPS checklists, passenger information cards, etc. required in emergencies such as loss of power situations will remain available as paper-based products.

DETERMINING THE CURRENT VERSION OF NATOPS PRODUCTS

Before using this product, ensure you have the latest version by verifying the dates of publications in use match those available on the NAVAIR Airworthiness and CYBERSAFE website at https://airworthiness.navair.navy.mil or on the Naval Air Technical Data and Engineering Services Command (NATEC) website at https://mynatec.navair.navy.mil. See the Record of Changes page for a current listing of this NATOPS product set.

KEEPING NATOPS PRODUCTS CURRENT

NATOPS products must be kept current through an active change program. Corrections, additions to, deletions from, and suggestions for improving contents should be submitted as NATOPS Change Recommendations (CRs) as soon as possible after discovery. CRs shall be worded as specifically as possible. CRs may be submitted by anyone in accordance with CNAF M-3710.7. All users are encouraged to contribute to the currency, accuracy, and usefulness of this and other NATOPS products by submitting timely CRs. Content standards for NATOPS products are found in MIL-DTL-85025B(AS), available at https://airworthiness.navair.navy.mil.

THE NATOPS CR PROCESS

Categories of CRs. NATOPS CRs are submitted as URGENT, PRIORITY or ROUTINE. URGENT and PRIORITY CRs usually involve safety-of-flight matters that require resolution prior to the next scheduled update. Some PRIORITY change recommendations may be upgraded to URGENT by NAVAIR (AIR-4.0P), by the NAVAIR Program Class Desk or by the NATOPS Model Manager.

Classifications of ROUTINE CRs. ROUTINE category CRs are further classified as follows:

Technical - Typically those CRs which affect systems description and/or limitations which must be confirmed/evaluated by engineers. Approved Technical CRs are bundled and issued as part of the next NATOPS update. CRs are also the fleet entry point for NATOPS technical information and/or assistance requests.

Operational - CRs which affect the operation of aircraft/systems. These typically involve changes in procedures. Approved operational CRs are incorporated via the next update, unless otherwise directed by the NATOPS PM.

Administrative - CRs which correct obvious errors requiring no further review (duplications, grammar, numbering, etc.). Approved Administrative CRs are incorporated via the next NATOPS update.

Submitting NATOPS CRs. The preferred means of submitting NATOPS CRs is through the Airworthiness Issues Resolution System (AIRS). AIRS may be accessed at https://airworthiness.navair.navy.mil. AIRS is the fastest and most efficient means of processing and resolving NATOPS CRs. In the event that a connection to AIRS is not available, URGENT and PRIORITY CRs may be submitted via naval message in accordance with CNAF M-3710.7.

UPDATES TO NATOPS PRODUCTS

NATOPS publications are reviewed, and updates issued, at regular intervals as determined by the NATOPS Program Manager. CRs are held and compiled into a regularly scheduled update. This ensures that CRs do not languish, and are incorporated in a timely manner. Updates are announced via naval messages. Updates are delivered in the form of revisions; for paper publications/products, this may involve making pen-and-ink entries and/or replacing pages. Update messages and update contents are posted on the Airworthiness and CYBERSAFE website at https://airworthiness.navair.navy.mil and on the NATEC website at https://mynatec.navair.navy.mil.

OBTAINING PAPER COPIES OF NATOPS PRODUCTS

One-Time Orders. Paper copies of eProduct NATOPS updates are not available through the naval supply system, but may be ordered in limited quantities through the NATEC print-on-demand system by contacting the FRCSW Logistics Element Manager with appropriate justification at DSN 735-2425 or CML (619) 545-2425. Copies of paper products may be ordered from the Naval Logistics Library (NLL) at https://nll.navsup.navy.mil, or through the naval supply system. They are also available in pdf format on the NAVAIR Airworthiness and CYBERSAFE website at https://mynatec.navair.navy.mil or on the NATEC website at https://mynatec.navair.navy.mil.

Note

- When the current revision of a paper product is ordered through the NLL, all active paper updates are shipped with the active revision.
- Quantities of a paper product ordered in excess of the maximum order quantity posted on the NLL website will not be shipped. If additional quantities are required, contact the FRCSW logistics element manager (LEM) at NATEC tels DSN 735-2425 or CML (619) 545-2425 for assistance.

Distribution. Upon request by the NATOPS Program Manager, NATEC sends printed copies of entire publications or updates to users whose NATOPS product requirements are maintained within its Automatic Distribution Requirements List (ADRL) database. NATEC also maintains an e-mail address list for each product in its ADRL database and automatically sends notices of all new paper and updated products to listed units. Detailed procedures

for establishing and maintaining an ADRL account are contained in NAVAIR technical manual 00-25-100 work package (WP) 007-00, available at https://mynatec.navair.navy.mil.

Note

To avoid cost and delivery inefficiencies that result from excessive or insufficient distributions, NATOPS Program Managers are authorized to adjust automatic distribution quantities of NATOPS products. Units should confirm their requirements with the NATOPS Program Manager in advance of distribution to ensure they receive sufficient quantities.

CHANGE SYMBOLS

Revised text in a paper product is indicated by a black vertical line in the margin of the page like the one adjacent to this paragraph or by highlighting the affected content. Change symbols in the margin next to the chapter number and title indicate a new or completely revised chapter.

SPECIAL TERMINOLOGY IN NATOPS PRODUCTS

The following special terminology applies to all NATOPS products.

Warnings, Cautions, and Notes. The following definitions apply to WARNINGS, CAUTIONS, and Notes:



Explanatory information about an operating procedure, practice, or condition, etc., that may result in injury, death, or loss of aircraft if not carefully observed or followed.



Explanatory information about an operating procedure, practice, or condition, etc., that may result in damage to equipment if not carefully observed or followed.

Note

Explanatory information about an operating procedure, practice, or condition, etc., that must be emphasized.

Requirement for compliance.

- "Shall" is used only when application of a procedure is mandatory.
- "Should" is used only when application of a procedure is recommended.
- "May" and "need not" are used only when application of a procedure is optional.
- "Will" indicates futurity and never indicates any degree of requirement for application of a procedure.

Requirement for landing aircraft.

- "Land Immediately" means execute a landing without delay.
- "Land as Soon as Possible" means land at the first site at which a safe landing can be made.
- "Land as Soon as Practicable" means extended flight is not recommended. The landing site and duration of flight are at the discretion of the pilot in command.

PART I

The Aircraft

Chapter 1 — General Description and Overview

Chapter 2 — Systems

Chapter 3 — Servicing and Handling

Chapter 4 — Operating Limitations

CHAPTER 1

General Description and Overview

1.1 PURPOSE

Chapter 1 provides an introductory description and overview of the UC-12W aircraft for use by operational planning and support personnel. It also lists the NATOPS and related flight clearance products applicable to the UC-12W aircraft and identifies the designated units responsible for the day-to-day management of the UC-12W NATOPS program.

1.2 DESCRIPTIVE DATA

1.2.1 Aircraft

The UC-12W aircraft manufactured by Hawker Beechcraft Corporation is an all-metal, low-wing, twin-turboprop, T-tail monoplane with an axial flow engine mounted on each wing. The flight and cabin compartment are pressurized for high-altitude flight. The cargo and airstair doors are located on the left side of the aircraft aft of the wing. The cargo door swings up to load light cargo, and the airstair door within the cargo door swings down, forming steps for entry and exit. Two plug type ground escape emergency exits are located on the left and right side of the fuselage at the forward ends of the passenger compartment.

The fuel supply is carried in the integral wing tanks, engine nacelle tanks, and extended range fuel tanks (if equipped). Fuel servicing is performed through the gravity flow fuel filler receptacles, one on each upper outboard wing surface and one on each upper inboard wing surface (auxiliary tank).

The basic mission of the UC-12W aircraft is to provide time sensitive transportation of passengers and/or light cargo.

1.2.1.1 Aircraft Dimensions

The overall dimensions, wingspan, length, and height of the aircraft are, refer to Figure 1-1:

- 1. WINGSPAN 57 feet, 11 inches.
- 2. LENGTH 46 feet, 8 inches.
- 3. HEIGHT 14 feet, 4 inches.

1.2.1.2 Aircraft Turning Radius

For the overall aircraft turning radius, refer to Figure 1-2.

1.2.1.3 Engines

- 1. Number of Engines Two.
- 2. Engine Manufacture Pratt & Whitney Canada Corp.
- 3. Engine Model Number PT6A-60A.
- 4. Engine Type Turboprop Engine.
- 5. Number of Drive Shafts Two:
 - a. One, Compressor (Gas Generator) Shaft.
 - b. One, Power Turbine Shaft.

- 6. Number and Type of Compressor Stages four:
 - a. Three, Axial-flow Stages.
 - b. One, Centrifugal-flow Stage.
- 7. Combustion Chamber Type Annular.
- 8. Turbine Stages and Types:
 - a. Compressor (Gas Generator) Turbine:

Single-stage Axial-flow Reaction Turbine.

b. Power Turbine:

Two-stage Axial-flow Reaction Turbine.

- 9. Engine Shaft-Horsepower Rating 1050 SHP.
- 10. Compressor (Gas Generator) Shaft Rotational Speed (N₁) Limits:

Take-off/Maximum Continuous/Cruise Climb/Max Cruise/Transient Power — 104.0% N₁.

11. Propeller Rotational Speed (N₁) Limits:

Take-off/Maximum Continuous/Cruise Climb/Max Cruise/ Power — 1,700 rpm.

1.2.1.4 Propellers

- 1. Number of Propellers Two.
- 2. Propeller Manufacturer Hartzell Propeller Inc.
- 3. Number of Blades Four.
- 4. Propeller Diameter 105.0 inches.
- 5. Propeller Type Constant-speed, Full-feathering, Reversing, Counter-weighted, Hydraulically Actuated.
- 6. Propeller Blade Angles at 42-inch (107 CM) Station:
 - a. Feathered +79.3 degrees.
 - b. Reverse 14 degrees.

1.2.1.5 Cabin And Entry Dimensions

- 1. Cabin Width, (Maximum) 54 inches (137 cm).
- 2. Cabin Length, (Maximum between pressure bulkheads) 24 feet, 10 inches (7.6 m).
- 3. Cabin Height, (Maximum) 57 inches (145 cm).
- 4. Airstair Entrance Door Width, (Minimum) 20.2 inches (51 cm).
- 5. Airstair Entrance Door Height, (Minimum) 46 inches (117 cm).
- 6. Cargo Door Width, (Minimum) 49 inches (124 cm).
- 7. Cargo Door Height, (Minimum) 52 inches (132 cm).
- 8. Pressure Vessel Volume 443 cubic feet (12.5 cubic m).
- 9. Potential Cargo-Area Volume 303 cubic feet (8.6 cubic m).

1.2.1.6 Specific Loading

- 1. Wing Loading 48.4 pounds per square foot (236.3 kg per sq m).
- 2. Power Loading 7.14 pounds per shaft horsepower (3.2 kg per shp).

Figure 1-1. Three-View

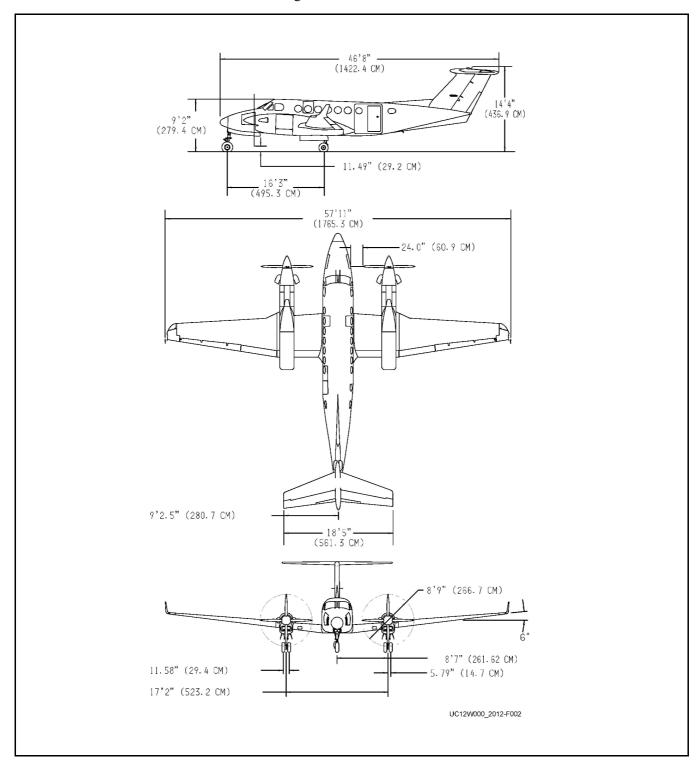
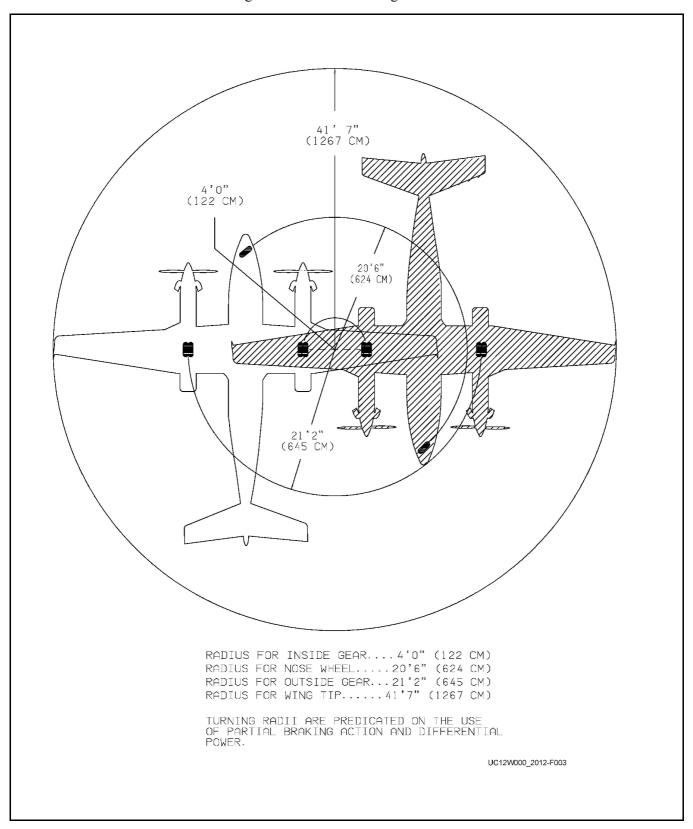


Figure 1-2. Ground Turning Clearance



1.3 AIRCRAFT FLIGHT CLEARANCES

Airworthiness is the property of an air system configuration that enables it to safely attain, sustain and terminate flight in accordance with the approved usage limits. CNAF M-3710.7 requires that prior to each flight, each naval aircraft, manned or unmanned, shall be certified that it is airworthy. Airworthiness certifications are issued by COMNAVAIRSYSCOM in the form of flight clearances. Permanent flight clearances are issued for standard T/M/S aircraft configurations, missions, and capabilities in the form of NATOPS NFM products, Naval Aviation Technical Information Product (NATIP) products, designated Original Equipment Manufacturer (OEM) products, and General Series NATOPS Manuals (NMs). Interim flight clearances are temporary clearances that are issued as stand-alone documents for non-standard aircraft configurations, missions, conditions, aircraft-related equipment and capabilities, or allow deviations from existing flight clearances for specific instances. All current flight clearances may be found on the NAVAIR Airworthiness and CYBERSAFE website, https://airworthiness.navair.navy.mil. NAVAIRINST 13034.1-series provides further guidance concerning flight clearances. NAVAIRSYSCOM (AIR-4.0P) is the final authority within the Navy and Marine Corps on airworthiness issues.

1.4 FLIGHT CLEARANCE PRODUCTS

Permanent flight clearances for the UC-12W aircraft are contained in the following T/M/S product sets:

1.4.1 UC-12W NATOPS Product Set

Each NFM contains operating procedures and information for specific T/M/S aircraft and is supplemented by additional supporting products to form a set of NATOPS products for each T/M/S aircraft. The UC-12W NATOPS product set is comprised of the following publications:

NATOPS Flight Manual (NFM), Navy Model UC-12W Aircraft
NATOPS Flight Manual Survivability Supplement (SNFMM), Navy Model UC-12W Aircraft
NATOPS Flight Manual Performance Data Supplement (SNFMP), Navy Model UC-12W Aircraft
NATOPS Card Checklist (CCL), Navy Model UC-12W Aircraft
NATOPS Functional Checkflight Checklist Navy Model UC-12W Aircraft

1.4.2 UC-12W OEM Product Set

The UC-12W aircraft OEM Product Set is comprised of the following products:

Operator's Guide, Collins Pro Line 21 Avionics System with Optional IFIS for the Hawker Beechcraft King Air, P/N 523-0790065-003117, dated August 15, 2003 or later revision.

Operator's Guide, Collins FMS-3000 Flight Management System, the Hawker Beechcraft King Air B200/B300, P/N 523-0790066-003117, dated August 15, 2003 or later revision.

Pilots Guide for the Electronic Standby Instrument System, Model GH-3100 (P/N TP-560, Rev F), L3 Technologies, Aviation Products, Publication Part No. 501-1860-Rev (-) dated July 22, 2009.

Pilots Guide for the Aviation Communications and Surveillance Systems (ACSS) TAWS+ Document No. 8006772-001, dated March 2007, or later revision.

Operators Guide, Collins IFIS-5000 Integrated Flight Information System Operators Guide, Document 523-0806347-005117, 5th edition, dated 4 April 2007, or later revision.

1.5 UC-12W AIRCRAFT NATOPS PROGRAM MANAGEMENT ASSIGNMENTS

Commanders are designated to perform the duties of and carry out UC-12W aircraft NATOPS program management responsibilities IAW CNAF M-3710.7 as follows:

1.5.1 NATOPS Model Manager Unit

VMR Belle Chasse is designated as the NATOPS Model Manager Unit for UC-12W aircraft NATOPS products. Contact information for VMR Belle Chasse is as follows:

Message PLAD: VMR BELLE CHASSE Address: VMR BELLE CHASE

ATTN: UC-12W NATOPS MODEL MANAGER

400 RUSSELL AVE BLDG 263

NAS JRB NOLA

BELLE CHASSE LA 70143

Telephone: CML: 504-678-3470

DSN: 678-3470

1.5.2 NATOPS Advisory Group

The following commands are designated as members of the NATOPS Advisory Group for the UC-12W aircraft NATOPS Product Set:

NATOPS Advisory Group Members Representative's Code

Commandant of the Marine Corps HQMC (SD)

Commander, Naval Air Force NAVAIRFOR (N455)

Commander, Naval Systems Command NAVAIRSYSCOM (AIR-4.0P/5.0F)

Commander, Marine Forces Command MARFORCOM (DSS)

Commander, Marine Forces, Pacific MARFORPAC (SAFETY)

Commanding General, Fourth Marine Aircraft Wing FOURTH MAW (DOSS)

Commander, Naval Safety Center NAVSAFECEN (Code 111D)

Commanding Officer, Fixed Wing Marine Transport VMR Belle Chasse

Squadron

OINC, Navy Survival Training Institute NAVSURVTRAINST

1.5.3 NATOPS Cognizant Command

The Fourth Marine Aircraft Wing is designated as the Cognizant Command for the UC-12W aircraft NATOPS Product Set.

1.6 OTHER RELATED PRODUCTS

Aircrew members should be familiar with the following products which supplement the UC-12W aircraft NATOPS product set.

NAVAIR 00-80T-112 NATOPS Instrument Flight Manual NAVAIR 00-80T-123 NATOPS Aircrew Systems Manual

CHAPTER 2

Systems

2.1 FLIGHT CONTROLS

2.1.1 Control Surfaces

The airplane is equipped with conventional ailerons and rudder. It utilizes a T-tail horizontal stabilizer and elevators, mounted at the extreme top of the vertical stabilizer.

2.1.2 Operating Mechanisms

The ailerons and elevators are operated by conventional control wheels interconnected by a T-bar. The rudder pedals are interconnected by linkage below the floor. These systems are connected to the control surfaces through push-rod and cable-and-bellcrank systems. Rudder, elevator, and aileron trim are adjustable with controls mounted on the center pedestal. A position indicator for each of the trim tabs is integrated with its respective control.

2.1.2.1 Control Wheel

The pilot and copilot Control Wheels (Figure 2-1) are identical except the switches are located on opposite control wheel grips.

2.1.2.2 Manual Elevator Trim

Manual control of the elevator trim is accomplished with a trim control wheel located on the left side of the pedestal. It is a conventional trim wheel which is rolled forward for nose-down trim, and aft for nose-up trim.

2.1.2.3 Electric Elevator Trim

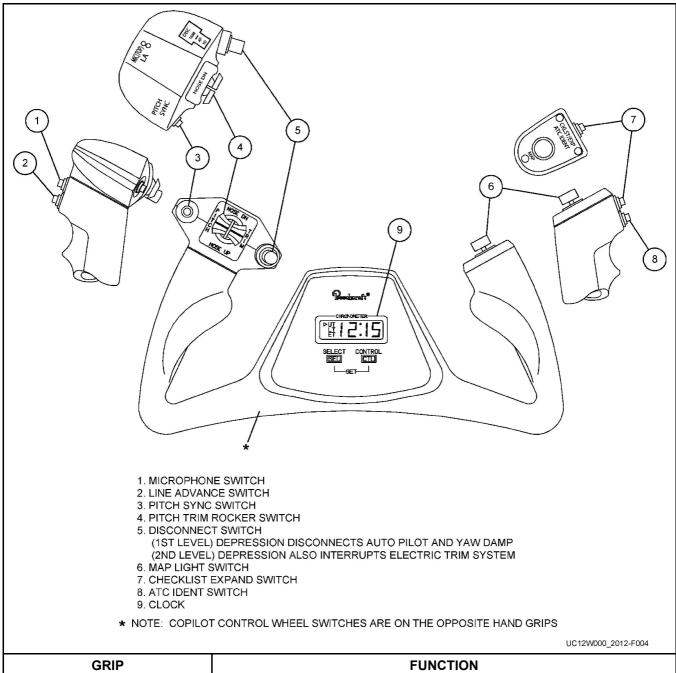
The electric elevator-trim system (installed in conjunction with the autopilot system) is controlled by a dual-element thumb switch on each control wheel, a trim-disconnect switch on each control wheel, and a PITCH TRIM circuit breaker in the Flight group on the Right Circuit Breaker Panel (Figure 2-22). Both elements of either dual-element thumb switch must be simultaneously moved forward to achieve nose-down trim, aft for nose-up trim; when released, they return to the center (OFF) position. Any activation of the trim system by the copilots thumb switch can be overridden by the pilots thumb switch. No one switch element should activate the system; only the simultaneous movement of a pair of switch elements in the same direction should activate the system.

A bi-level, push-button, momentary-on, trim-disconnect switch is located inboard of the dual-element thumb switch on the outboard grip of each control wheel. The electric elevator-trim system can be disconnected by depressing either of these switches. Depressing either trim-disconnect switch to the first of the two levels disconnects the autopilot, yaw damp and rudder boost systems; depressing the switch to the second level disconnects the electric elevator-trim system. The manual-trim control wheel can be used to change the trim anytime the autopilot is off, whether or not the electric trim system is in the operative mode.

2.1.2.4 Rudder Boost

The rudder boost is enabled by setting the pedestal mounted control switch, placarded RUDDER BOOST-OFF, to the RUDDER BOOST position and the FGC Panel Switch AP/YD DISC bar up. The system senses engine torque from both engines. When the difference in these torques exceeds a preset level, the electric servo is activated and deflects the rudder, which assists pilot effort. The servo contribution is proportional to the engine torque differential. Trimming of the rudder must be accomplished by the pilot. The rudder boost system is disabled if the RUDDER BOOST switch is OFF and interrupted when the DISC TRIM/AP YD switch is depressed.

Figure 2-1. Control Wheel



GRIP

Outboard, Pilot

TCS, Microphone-Interphone, Electronic Elevator trim, and Autopilot-Yaw Damp/Trim Disconnect.

Inboard, Pilot

ATC Indent and Map Light.

Outboard, Copilot

ATC Indent and Map Light.

TCS, Microphone-Interphone, Electronic Elevator Trim, and Autopilot-Yaw Damp/Trim Disconnect.

Center

Quartz Chronometer/Timer.

An amber RUD BOOST OFF caution annunciator is provided on the caution/advisory/status annunciator panel to indicate that the rudder boost system is inoperative due to either the rudder boost control switch in the OFF position or the trim-disconnect switch on either control yoke.

2.2 GLARESHIELD, INSTRUMENT PANEL, SUBPANELS, AND EXTENDED PEDESTAL

The operation and use of the instruments, lights, switches, and controls located on the Glareshield (Figure 2-2) are explained under the system descriptions relating to the subject items.

The operation and use of the instruments, lights, switches, and controls located on the Instrument Panel (Figure 2-3) are explained under the system descriptions relating to the subject items.

The operation and use of the instruments, lights, switches, and controls located on the Left Subpanels (Figure 2-4) are explained under the system descriptions relating to the subject items.

The operation and use of the instruments, lights, switches, and controls located on the Right Subpanels (Figure 2-5) are explained under the system descriptions relating to the subject items.

The operation and use of the instruments, lights, switches, and controls located on the Extended Pedestal (Figure 2-6) are explained under the system descriptions relating to the subject items.

Figure 2-2. Glareshield

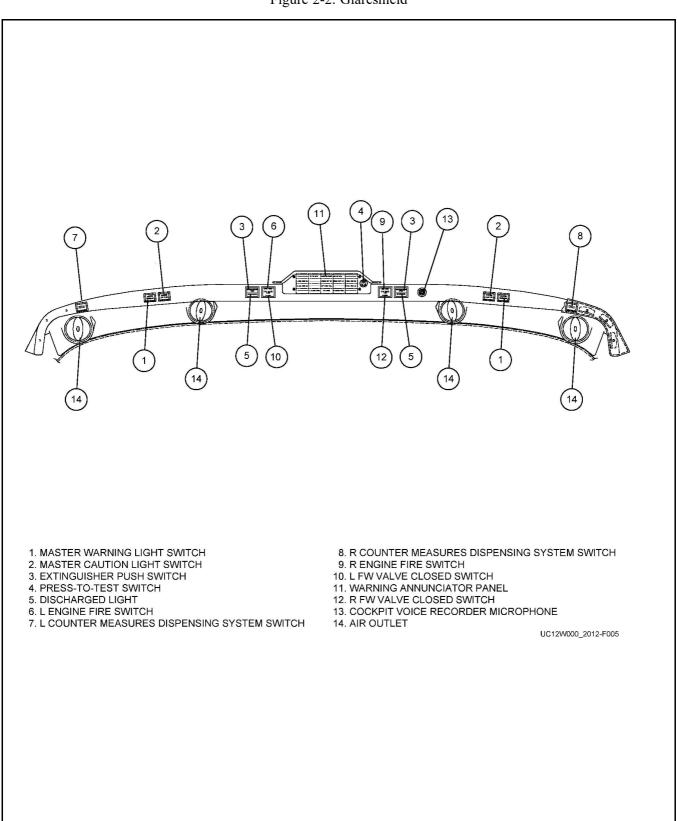


Figure 2-3. Instrument Panel

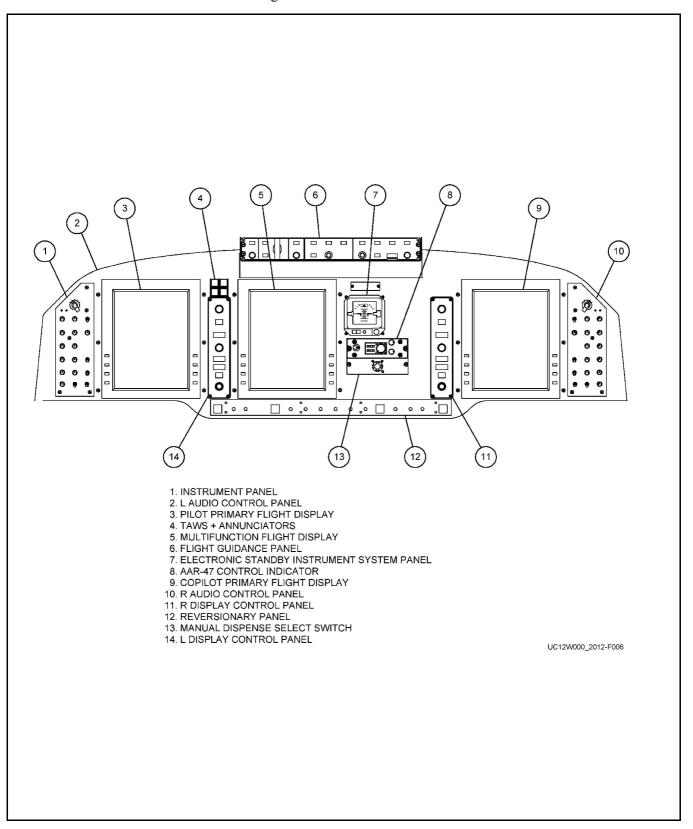
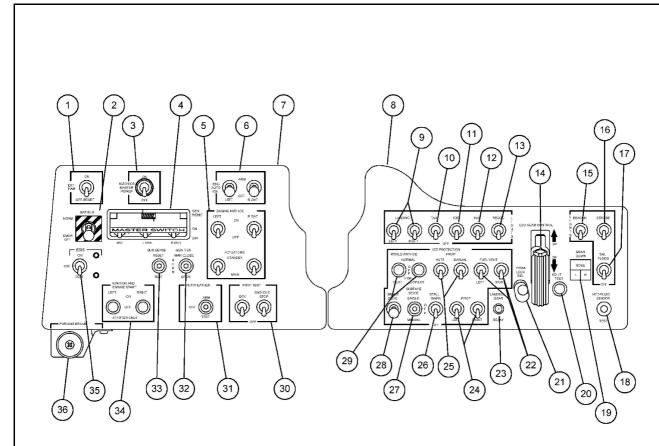


Figure 2-4. Left Subpanels

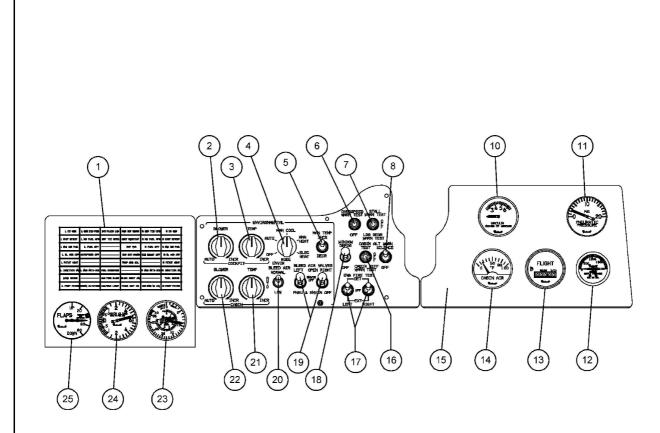


- 1. External Power Switch
- 2. Battery Bus Switch
- 3. Avionics Master Switch
- 4. Master BAT/L GEN/R GEN Switch
- 5. Engine Anti-ice Switches
- 6. Engines Auto-Ignition Switches
- 7. Right Outboard Subpanel
- 8. Right Inboard Subpanel
- 9. Landing Light Switches
- 10. Taxi Light Switch
- 11. ICE Light Switch
- 12. NAV Light Switch
- 13. Recog Light Switch
- 14. Landing Gear Control Handle
- 15. Beacon Light Switch
- 16. Strobe Light Switch
- 17. Tail Flood Light Switch
- 18. Hydraulic Fluid Sensor Test Button

- 19. Landing Gear Position Indicator Lights
- 20. HDL Light Test
- 21. Landing Gear Handle Down Lock Release
- 22. Fuel Vent
- 23. Landing Gear Relay Circuit Breaker
- 24. Pitot Switches
- 25. Prop Anti-ice Switches
- 26. Stall Warn Switch
- 27. Surface Deice Switch
- 28. Brake Deice Switch
- 29. Windshield Anti-ice Switches
- 30. Prop Test Switches
- 31. Autofeather Switch
- 32. Generator Ties Switch
- 33. Bus Sense Reset/Test Switch
- 34. Ignition and Engine Start Switches
- 35. ESIS Switch
- 36. Parking Brake

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Figure 2-5. Right Subpanels

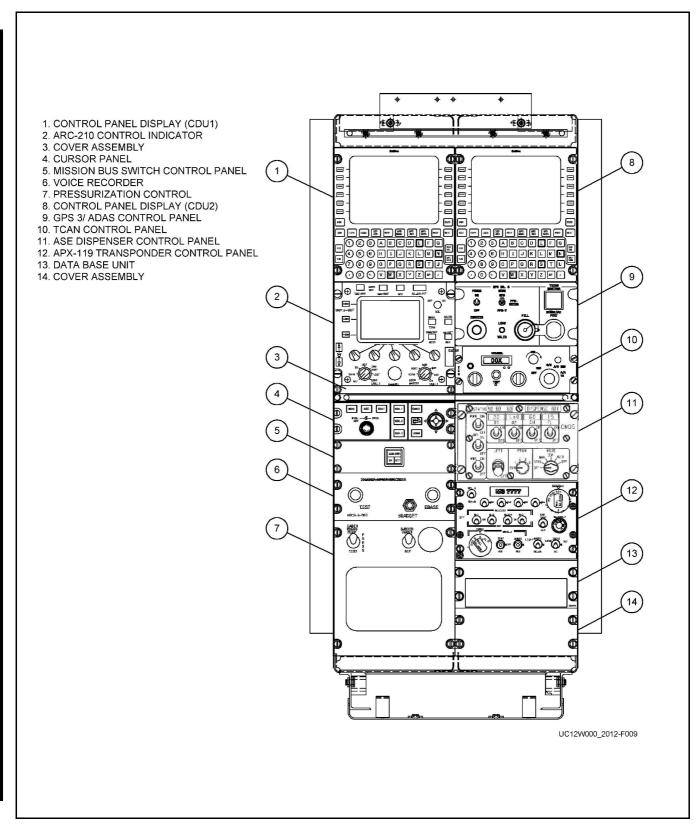


- 1. Caution and Advisory Annunciator Panel
- 2. Cockpit Blower Knob
- 3. Cockpit TEMP Knob
- 4. Temperature Mode Control Knob
- 5. Manual Temperature Control Switch
- 6. Overspeed Warn Test Switch
- 7. Stall Warn and LDG Gear Warn Test Switch
- 8. Cabin ALT Warn Silence Switch
- 9. Left Outboard Subpanel
- 10. Vacuum Gauge
- 11. Pneumatic Pressure Gauge
- 12. Oxygen Pressure Gauge
- 13. Flight Hour Meter

- 14. Cabin Air Temperature Gauge
- 15. Left Inboard Subpanel
- 16. Cabin ALT and Cabin DIFF Warn Test Switch
- 17. Engine Fire Test Switches
- 18. Window Defog Switch
- 19. Bleed Air Valve Switches
- 20. Environmental Bleed Air Switch
- 21. Cabin TEMP Knob
- 22. Cabin Blower Knob
- 23. Cabin Altitude and Differential Pressure Gauge
- 24. Cabin Climb Rate Indicator
- 25. Flaps Position Indicator

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Figure 2-6. Extended Pedestal



2.3 REVERSIONARY PANEL

The reversionary panel is located in the lower-middle section of the instrument panel. The following are descriptions of functions performed by the components located on the Reversionary Panel (Figure 2-7):

: : Ò \Box 0 0 0 0 0 0 ୍ତ <u>්</u>ම් *@* ම ⊸⊚⊸ **⊚ ၈** DETAIL A 1. PROP SYNC REVERSIONARY SWITCH 8. ADC REVERSION SWITCH 2. DG REVERSIONARY SWITCH 9. TUNE REVERSION SWITCH 3. SLEW REVERSIONARY SWITCH 10. EMERGENCY FREQUENCY SWITCH (121.5) 4. STORMSCOPE CLEAR SWITCH 11. RTM TUNE SWITCH 5. ATC REVERSIONARY SWITCH 12. SLEW REVERSIONARY SWITCH 6. PILOT DISPLAY SWITCH 13. DG REVERSIONARY SWITCH 7. AHRS REVERSION SWITCH 14. GND COM REVERSION SWITCH UC12W000_2012-F010

Figure 2-7. Reversionary Panel

SWITCH	FUNCTION			
Prop Sync	Activates the Propeller Synchro Phaser Control Unit.			
DG (left or right)	Selects FREE (manual) or NORM (Slave) mode to cause the AHC to not use the FDU input or slave to the heading sensed by the FDU. Set the switch to FREE (free gryo) to select the directional gyro mode. In the FREE mode, the AHC does not use the magnetic heading sensed by the FDU. Set the switch to NORM (Slave) to select the normal mode. In this mode, the AHC heading computations are slaved to the magnetic heading sensed by the FDU.			
Slew -/+ (left or right)	Used to slew the AHC heading computations and the heading on the compass rose in the selected direction. Push the momentary slew switch to the SLEW - position to turn the compass card clockwise. Push the momentary slew switch to the SLEW + position to turn the compass card counter-clockwise.			
Dispenser, Disable/enable	Used to disable or enable the aircraft survivability equipment flare dispenser.			
Stormscope Clear	Used to clear displayed images on the PFD or MFD and refresh to a new updated image.			

Figure 2-7. Reversionary Panel (cont.)

SWITCH	FUNCTION
Pilot Display	Selects the reversionary PFD or MFD display. In the NORM position, each instrument shows the normal PFD and MFD displays. In the PFD position, the left or right PFD shows the composite reversionary display and the MFD blanks. All MFD information is moved to the pilot PFD. Use this function if the MFD fails. In the MFD position, the MFD shows the composite reversionary display and the left PFD blanks. Use the function if the PFD fails.
AHRS	Used to select the attitude and heading source for the PFD and MFD displays as follows:
	NORM position, AHRS1 supplies data to the pilot side systems, AHRS2 supplies data to copilot side systems.
	Position 1, AHRS1 data is supplied to both the pilot and copilot systems, AHRS2 data is isolated.
	Position 2, AHRS2 data is supplied to both the pilot and copilot systems, AHRS1 data is isolated.
ADC	Used to select the air data source for the PFD and MFD displays as follows:
	NORM position, ADC1 supplies data to the pilot side systems, ADC2 supplies data to the copilot systems.
	Position 1, provides ADC1 data to both pilot and copilot systems, ADC2 data is isolated.
	Position 2, provides ADC2 data to both pilot and copilot systems, ADC1 data is isolated.
Tune, CDU/CDU2	With this switch in the NORM position radios may be tuned using either the CDU1 or CDU2. Should the CDU1 become inoperable, the CDU/CDU2 TUNE switch must be placed to the CDU2 position, and the radios are tuned using CDU2. Likewise, if the CDU2 should become inoperable, the CDU/CDU2 TUNE switch must be placed in the CDU position and the radios tuned using the CDU.
EMER FREQ	A push-on/push-off switch is used to force the 1 VHF COMM radio to tune to the emergency 121.5 MHz frequency. In addition, the left and right CDUs cannot tune the number 1 VHF COMM radio while in this position.
RMT Tune	Moving this switch from the NORM position to the DISABLE position will disable the auto tuning function of the CDU.
GND COM ON	A push-on/push-off switch is used to power the pilot side CDU and the number 1 VHF COMM radio when the battery switch is set to off only. When the battery switch is set to on, the GND COM function is disabled.

2.4 ANNUNCIATOR SYSTEM

The annunciator system consists of a warning annunciator panel (red) centrally located in the Glareshield (Figure 2-8), and a Caution/Advisory/Status Annunciator panel (Figure 2-9) (caution — amber; advisory — green; status — white) located on the glareshield center subpanel. Two red MASTER WARNING flashers located in the glareshield (one in front of the pilot and one in front of the copilot) are a part of the system, as are two amber MASTER CAUTION flashers (located just inboard of the MASTER WARNING flashers), and a PRESS TO TEST button located immediately to the right of the warning annunciator panel.

The annunciators are of the word-readout type. Whenever a condition monitored by the annunciator system occurs, a signal is generated and the appropriate annunciator is illuminated.

Figure 2-8. Warning Annunciator Panel

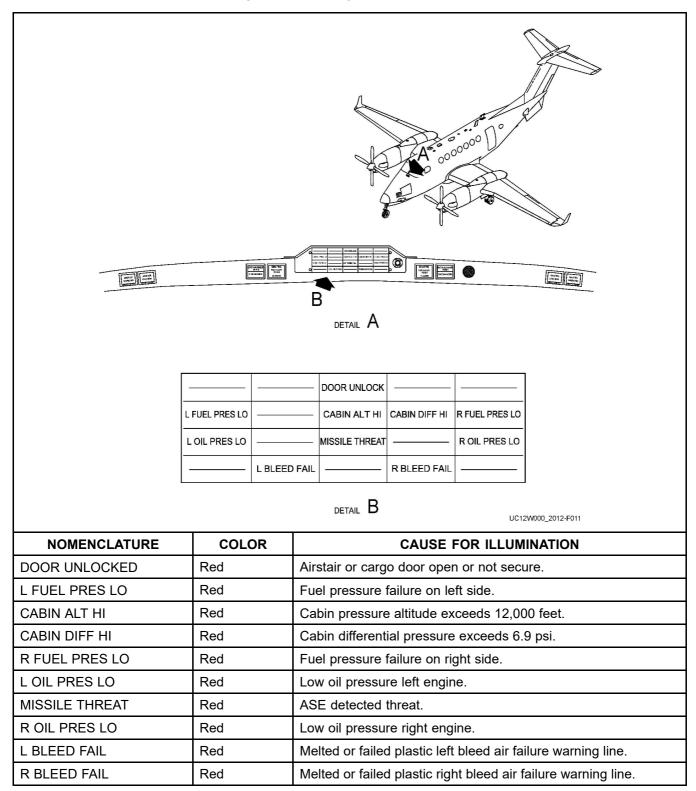
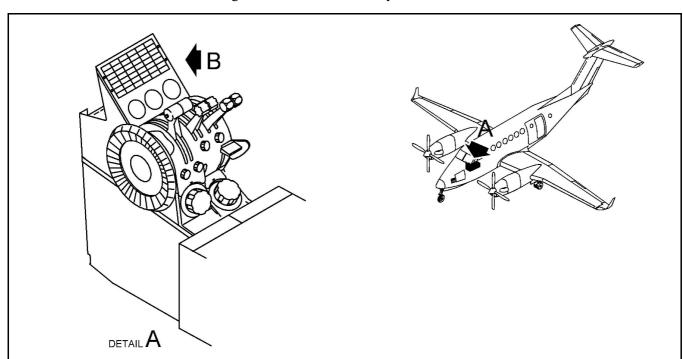


Figure 2-9. Caution/Advisory/Status Panel



L DC GEN	L GEN TIE OPEN	HYD FLUID LOW	RVS NOT READY	R GEN TIE OPEN	RDC GEN
L CHIP DETECT	L NO FUEL XFR	BAT TIE OPEN	DUCT OVERTEMP	R NO FUEL XFR	R CHIP DETECT
L ENG ICE FAIL	L FUEL QTY	ELECT HEAT ON	EXT PWR	R FUEL QTY	R ENG ICE FAIL
L BL AIR OFF	AUTOFTHER OFF		OXY NOT ARMED	RUD BOOST OFF	R BL AIR OFF
L PITOT HEAT	CVDR/FDR FAIL		PROP GND SOL	IFF	R PITOT HEAT
L IGNITION ON	L ENG ANTI-ICE	FUEL CROSSFEED		R ENG ANTI ICE	R IGNITION ON
WING DEICE	L BK DEICE ON	MAN TIES CLOSE		R BK DEICE ON	TAIL DEICE
L PROP PITCH	CABIN ALTITUDE	LDG/TAXI LIGHT	PASS OXY ON	AIR COND N ₁ LOW	R PROP PITCH

 $\mathsf{DETAIL}\,B$

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NOMENCLATURE COLOR		CAUSE FOR ILLUMINATION	
L DC GEN	Amber	Left generator off the line.	
L GEN TIE OPEN	Amber Left generator bus isolated from center bus.		
HYD FLUID LOW Amber		Hydraulic fluid in the power pack is low.	
RVS NOT READY	Amber	Propeller levers are not in the high rpm, low pitch position with landing gear extended.	

Figure 2-9. Caution/Advisory/Status Panel (cont.)

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
R GEN TIE OPEN	Amber	Right generator bus isolated from center bus.
R DC GEN	Amber	Right generator off the line.
L CHIP DETECT	Amber	Metal contamination in the left engine oil is detected.
L NO FUEL XFR	Amber	No left auxiliary fuel transfer.
BAT TIE OPEN	Amber	Battery isolated from generator buses.
DUCT OVERTEMP	Amber	Duct air too hot.
R NO FUEL XFR	Amber	No right auxiliary fuel transfer.
R CHIP DETECT	Amber	Metal contamination in right engine oil is detected.
L ENG ICE FAIL	Amber	Left engine selected anti-ice system is inoperative.
L FUEL QTY	Amber	Left fuel quantity — less than 30 minutes remaining at maximum continuous power.
ELEC HEAT ON	Amber	Electric heat is on.
EXT PWR	Amber	External power connector is plugged in.
R FUEL QTY	Amber	Right fuel quantity — less than 30 minutes remaining at maximum continuous power.
R ENG ICE FAIL	Amber	Right engine selected anti-ice system inoperative.
AUTOFTHER OFF	Amber	Autofeather switch is not armed and landing gear is extended.
OXY NOT ARMED	Amber	Oxygen arming handle not pulled or system failed to charge.
RUD BOOST OFF	Amber	Rudder Boost Switch is OFF.
R BL AIR OFF	Amber	Right bleed air flow control valve is closed.
L PITOT HEAT	Amber	Left Pitot Heat inoperative or switch is in the OFF position.
CVDR/FDR FAIL	Amber	Internal fault with either CVDR or FDR.
PROP GND SOL	Amber	28V is being delivered to one or both ground idle low pitch stop solenoids.
IFF	Amber	IFF is inoperative.
R PITOT HEAT	Amber	Right Pitot Heat inoperative or switch is in the OFF position.
L IGNITION ON	Green	Left ignition and engine start switch is on, or left auto ignition system is armed and left engine torque is below 17%.
L ENG ANTI-ICE	Green	Left engine anti-ice vanes in position for icing conditions.
FUEL CROSSFEED	Green	Crossfeed valve is open.
R ENG ANTI-ICE	Green	Right engine anti-ice vanes in position for icing conditions.
R IGNITION ON	Green	Right ignition and engine start switch is on, or right auto ignition system is armed and right engine torque is below 17%.
WING DEICE	Green	Wing surface deice system in operation.
L BK DEICE ON	Green	Left brake deice system in operation.
MAN TIES CLOSE	Green	Manually closed generator bus ties.
R BK DEICE ON	Green	Right brake deice system in operation.
TAIL DEICE	Green	Horizontal stabilizer surface deice system in operation.

Figure 2-9. Caution/Advisory/Status Panel (cont.)

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
L PROP PITCH	White	Left propeller is below the flight idle stop.
CABIN ALTITUDE	White	Cabin Altitude exceeds 10,000 feet.
LDG/TAXI LIGHT	White	Landing light(s) or taxi light on with landing gear up.
PASS OXYGEN ON	White	Passenger oxygen system charged.
AIR COND N ₁ LOW	White	Right engine N ₁ too low for air conditioning load.
R PROP PITCH	White	Right propeller is below the flight idle stop.

If the fault requires the immediate attention and reaction of the pilot, the appropriate red warning annunciator in the warning annunciator panel illuminates and both MASTER WARNING flashers begin flashing. Any illuminated lens in the warning annunciator panel will remain illuminated until the fault is corrected. However, the MASTER WARNING flashers can be extinguished by depressing the face of either MASTER WARNING flasher, even if the fault is not corrected. In such a case, the MASTER WARNING flashers will again be activated if an additional warning annunciator illuminates. When a warning fault is corrected, the affected warning annunciator will extinguish, but the MASTER WARNING flashers will continue flashing until one of them is depressed.

Whenever an annunciator-covered fault occurs that requires the pilots attention and a possible need for future corrective action, the appropriate amber caution annunciator in the caution/advisory/status panel illuminates, and both MASTER CAUTION flashers begin flashing. The MASTER CAUTION flashers can be extinguished by pressing the face of either of the flashing annunciators. Subsequently, when any caution annunciator illuminates, the MASTER CAUTION flashers will again be activated. An illuminated caution annunciator on the caution/advisory/status annunciator panel will remain illuminated until the fault condition is corrected, at which time it will extinguish. The MASTER CAUTION flashers will continue flashing until one of them is depressed.

The caution/advisory/status annunciator panel also contains the green advisory and white status annunciators. There are no master flashers associated with these annunciators. The green advisory annunciators confirm that an operation initiated by the pilot did occur as required. They do not require immediate pilot alerting or any further pilot action. The white status annunciators indicate a condition which can be normal or abnormal. They do not require immediate pilot alerting or action.

The annunciators, MASTER WARNING and MASTER CAUTION flashers feature automatic bright and dim modes of illumination intensity.

2.5 GROUND CONTROL

Direct linkage from the rudder pedals allows for nose wheel steering.

2.6 FLAPS

The flaps are operated by a sliding switch handle on the pedestal just below the condition levers. Flap travel is registered on an electric indicator on top of the pedestal. Three detents provide for quick selection of UP, TAKEOFF AND APPROACH, and DOWN positions. The flaps cannot be stopped in an intermediate position. A safety mechanism is provided to disconnect power to the electric flap motor in the event of a malfunction which would cause any flap to be three to six degrees out of phase with the other flaps.

2.7 LANDING GEAR

The nose and main landing gear assemblies are retracted and extended hydraulically.

For manual extension of the landing gear, a lever is located on the floor on the pilots side of the pedestal.

The hydraulic landing gear is actuated by a switch placarded LDG GEAR CONTROL - UP - DN located on the Left Subpanels (Figure 2-4). The LDG GEAR CONTROL must be pulled out of a detent prior to moving it to the UP or DN position. An overload protection circuit protects the system from electrical overload.

Safety switches on the main gear open the control circuit when the strut is compressed. This prevents the LDG GEAR CONTROL from being raised when the airplane is on the ground. The safety mechanism automatically disengages when the airplane leaves the ground, and can be overridden by pressing down on the red DOWN LOCK REL button located to the left of the LDG GEAR CONTROL. Never move the LDG GEAR CONTROL out of the DN detent while the airplane is on the ground. If it is, the landing gear warning horn will sound intermittently and a red indicator light located in the LDG GEAR CONTROL will illuminate (provided the BAT SWITCH is ON), indicating the gear is in transit or not locked, also warning the pilot to return the LDG GEAR CONTROL to the DN position. This light will also illuminate when the landing gear warning horn is actuated. The red LDG GEAR CONTROL light may be checked by pressing the HD LT TEST button located to the right of the LDG GEAR CONTROL. The warning horn and the LDG GEAR CONTROL light are tested by actuation of the LDG GEAR WARN TEST-OFF switch.

In flight, as the landing gear moves to the full down position, the down lock switches are actuated and interrupt current to the pump motor. When the red in-transit light in the LDG GEAR CONTROL extinguishes, the landing gear are in the fully retracted or extended position. Hydraulic system pressure maintains the gear in the up position.

An amber HYD FLUID LOW caution annunciator in the Caution/Advisory/Status Annunciator panel (Figure 2-9) will illuminate whenever the hydraulic fluid in the power pack is low.

Visual indication of landing gear position is provided by individual green GEAR DOWN annunciators NOSE - L - R on the Left Subpanels (Figure 2-4). The green annunciators may be checked by pressing the annunciators cap.

When the landing lights are left on with the landing gear up, a white LDG/TAXI LIGHT annunciator will illuminate.

2.7.1 Hydraulic System

The system is powered by an electric motor-driven pump and requires approximately six seconds to operate the gear to either the up or down position. The gear is held in the retracted position by system pressure. A recharging of the accumulator may be expected a few minutes after retraction; additional recharging may occur during the flight. When extended, the landing gear is mechanically locked in the down position.

2.7.2 Landing Gear Warning System

The landing gear warning system is provided to warn the pilot that the landing gear is not down and locked during specific flight regimes. Various warning modes result, depending upon the position of the flaps.

With the FLAPS in either the UP or APPROACH position and either or both power levers retarded below approximately 85% N₁, the warning horn will sound intermittently and the LDG GEAR CONTROL lights will illuminate. The horn can be silenced by pressing the GEAR WARN SILENCE button located on the left power lever. The lights in the LDG GEAR CONTROL cannot be extinguished. The landing gear warning system will be rearmed if the power lever(s) are advanced sufficiently.

With the FLAPS beyond APPROACH position, the warning horn and LDG GEAR CONTROL lights will be activated regardless of the power settings, and neither can be cancelled.

2.7.3 Landing Gear Manual Extension

An alternate extension handle, placarded LANDING GEAR ALTERNATE EXTENSION, is located on the floor on the pilots side of the pedestal. To engage the system, pull the LANDING GEAR RELAY circuit breaker, located to the left of the LDG GEAR CONTROL on the Left Subpanels (Figure 2-4), and ensure that the LDG GEAR CONTROL is in the DN position. Remove the alternate extension handle from the securing clip and pump up and down. While pumping, do not lower the handle below the level of the securing clip during the down stroke as this will allow accumulated hydraulic pressure to bleed off. Continue the pumping action until the three green gear-down annunciators are illuminated and further resistance is felt, then stow the handle in the securing clip. If one or more gear-down annunciators do not illuminate, the alternate extension handle must not be stowed. Instead, leave it at the top of the up stroke. Continue to pump the handle when conditions permit until the gear is mechanically secured

after landing. Refer to Landing Gear Manual Extension in Chapter 13, Abnormal Procedures. If any of the following conditions exist, it is likely that an unsafe gear indication is due to an unsafe gear and is not a false indication.

- 1. The inoperative gear down annunciator illuminates when tested.
- 2. The red lights in the handle are illuminated.
- 3. The gear warning horn sounds when one or both power levers are retarded below 85% N₁.

After a practice manual extension of the landing gear, the gear may be retracted hydraulically. Refer to Landing Gear Retraction After Practice Manual Extension in Chapter 7, Shore-Based Procedures.

2.7.4 Brake System

The dual hydraulic brakes are operated by depressing the toe portion of either the pilots or copilots rudder pedals. The parking brake control is located below the Left Subpanels (Figure 2-4). After the pilots brake pedals have been depressed to build up pressure in the brake lines, both valves can be closed simultaneously by pulling out the parking brake handle. This retains the pressure in the brake lines. The parking brake is released by depressing the pedals briefly to equalize the pressure on both sides of the valve, then pushing the parking brake handle in to open the valve.

2.7.5 Tires

The main gear is equipped with dual 22 x 6.75-10, 10-ply-rated, tubeless tires.

The nose gear is equipped with a 22 x 6.75-10, 8-ply-rated, tubeless tire.

2.8 BAGGAGE COMPARTMENT

A separate baggage compartment is provided aft of the passenger compartment, and is separated from the passenger area by a partition. The toilet is located on the aft wall of the baggage compartment. A nylon web is provided for the restraining of loose items. Refer to Dimensional and Loading Data and Seating Configuration Payload Locations in Chapter 23, Weight And Balance.



- Unless authorized by applicable regulations, do not carry hazardous material anywhere in the airplane.
- Do not carry children in the baggage compartment unless secured in a seat.
- Baggage and other objects must be secured by webs in order to prevent shifting in turbulent air.

2.9 SEATS, SEATBELTS, AND SHOULDER HARNESSES

2.9.1 Cockpit Seats

The pilot and copilot seats are adjustable fore, aft, and vertically by the use of release levers located beneath the seats. The angle of the seat is adjustable by depressing the release lever on the side of the seat. The armrests incorporate both angular adjustment and vertical stowing. To stow the armrest, release the lever on its forward end, then rotate the armrest aft to the vertical position.

2.9.2 Cabin Seats

2.9.2.1 Executive Seat

Passenger seats are installed on continuous tracks mounted on the floor and are placarded FRONT OR AFT FACING on the horizontal leg cross brace. All passenger seats, whether front or aft facing, are equipped with adjustable headrests and shoulder harnesses.

Passenger seats are adjustable fore and aft (7 inches (17.8 cm)), and laterally (2 1/2 inches (6.35 cm)), with seat backs that also may be adjusted for maximum comfort. Some passenger seats may also be swiveled through approximately 45 degrees for passenger comfort. All adjustments are accomplished by means of a 2-position lever located on the forward face of the inboard arm rest of each seat, and a button located on the inboard side of the armrest. Moving the 2-position lever upward releases the seat latches to allow for fore-and-aft and/or lateral adjustment. Releasing the lever locks the seat in the desired position. The seatback is adjusted by depressing the button on the armrest, placing the seatback in the desired position (by leaning against the seatback), then releasing the button. When no weight is applied to the seatback and the button is depressed, the seatback will return to the upright position.



Before takeoff and landing, lateral tracking seats should be in the outboard position, all seatbacks positioned upright, and all headrests fully extended to prevent injury to passengers.

The inboard armrest on each seat can be stowed if desired. To stow, lift the armrest to the full-up position, which unlatches the mechanism, then lower the armrest to the stowed position. To use the armrest, simply raise it to the full-up position and allow it to settle slightly to the locked position.

Note

If the armrest will not lock in the up position, cycle it fully down and back to the up position in order to reset the locking mechanism.

2.9.2.2 Non-Executive Seats

Seven non-executive seats are installed in the aircraft, four on the right side of the aircraft and three on the left. The passenger seats are fixed-position units with non-captive feet. Releasing the lever will allow the spring-loaded locks to engage and lock the seat into the tracks. The seats have adjustable headrests and reclining seatbacks. A release lever on the forward side of the seat will allow the passenger to recline the seatback to the desired position. Seatback movement will stop any time the lever is released. Actuating the release lever without any pressure against the seatback will cause the seatback to slowly rise to the fully upright position.

The seatback can also be folded forward to lay on the seat cushion after releasing the lock lever on the lower side of the seatback. The inboard armrest of each passenger seat can be lowered to allow movement in and out of the seat. To lower the armrest, lift the flat rectangular release plate located under the front end of the armrest and move the armrest downward. The armrest can be raised by moving it upward until it locks in place.

2.9.3 Baggage Compartment Seats

A hinged seat-cushion mounted on the top of the toilet forms an extra passenger seat when the toilet is not is use.

2.9.4 Seatbelts

Every seat in the airplane is equipped with a seatbelt. The fore and aft facing seats also have shoulder harnesses.

2.9.5 Cockpit Shoulder Harnesses

The cockpit shoulder harness installation for the pilot and copilot seats consists of a Y-strap mounted to an inertia reel located in the lower seatback. One strap is worn over each shoulder and terminates with a fitting which inserts

into a rotary buckle. The shoulder harness straps and inboard lap belt are released simultaneously by rotating the buckle release 1/8 of a turn in a clockwise direction.

2.9.6 Cabin Shoulder Harnesses

The cabin shoulder harness is worn diagonally and runs from the shoulder to the hip area where it is secured by hooking the metal fastener around the securing stud on the male half of the seatbelt buckle.

2.10 DOORS AND EXITS

2.10.1 Airstair Entrance Door

The airstair door is built into the cargo door. It is hinged at the bottom, and swings downward when opened. It has a stairway built onto the inboard side. Two of the stair steps fold flat against the door when the door is closed. When the door is opened, a self-storing platform automatically folds down over the door sill to protect the rubber door seal. A hydraulic damper ensures that the door will swing down slowly when it opens. While the door is open, it is supported by a plastic-encased cable, which also serves as a handrail. Additionally, this cable is utilized when closing the door from inside the airplane. An inflatable rubber seal is installed around the perimeter of the door, and seats against the door frame as the door is closed. When the cabin is pressurized, air seeps into the rubber seal through small holes in the outboard side of the seal. The higher the cabin differential pressure, the more the seal inflates. This is a passive-seal system with no mechanical connection to a bleed air source. The outside door handle can be locked with a key, for security of the airplane on the ground.



Only one person should be on the airstair door stairway at any one time to prevent damage to door components.

The door locking mechanism is operated by rotating either the outside or the inside door handle, both of which move simultaneously. Three hollow, crescent latches on each side of the door rotate to capture or release latch posts mounted in the cargo door to secure the airstair door. When latched, the airstair door becomes an integral part of the cargo door.

Whether unlocking the door from the outside or the inside, the release button adjacent to the door handle must be held depressed before the handle can be rotated (counterclockwise from inside the airplane, clockwise from outside) to unlock the door. Consequently, unlocking the door is a two-hand operation requiring deliberate action. The release button acts as a safety device to help prevent accidental opening of the door. As an additional safety measure, a differential-pressure-sensitive diaphragm is incorporated into the release-button mechanism. The outboard side of the diaphragm is open to atmospheric pressure, the inboard side to cabin air pressure. As the cabin-to-atmospheric pressure differential increases, it becomes increasingly difficult to depress the release button, because the diaphragm moves inboard when either the outboard or inside release button is depressed.

WARNING

- Never attempt to unlock or even check the security of the door in flight. This is to prevent the inadvertent opening of the door inflight.
- If the red DOOR UNLOCKED annunciator illuminates in flight, or if the pilot has any reason whatever to suspect that the door may not be securely locked, the cabin should be depressurized (after first considering altitude), and all occupants instructed to remain seated with their seatbelts fastened. After the airplane has made a full-stop landing and the cabin has been depressurized, only a crew member should check the security of the airstair door and the cargo door.

To close the door from outside the airplane, lift up the free end of the airstair door and push it up against the door frame as far as possible. Then grasp the handle with one hand and rotate it counterclockwise as far as it will go. The door will then move into the closed position. The release button should pop out, and the handle should be pointing aft. Check the security of the door by attempting to rotate the handle clockwise without depressing the release button; the handle should not move and remain facing aft.

To close the door from inside the airplane, grasp the handrail cable and pull the airstair door up against the door frame. Then grasp the handle with one hand and rotate it clockwise as far as it will go, continuing to pull inward on the door. The door will then move into the closed position. The release button should pop out, and the handle should be pointing down. Check the security of the door by attempting to rotate the handle counterclockwise without depressing the release button; the handle should not move. Next, lift the second folded airstep below the door handle. A placard adjacent to the round observation window advises the observer that the safety lock arm should be in position around the diaphragm shaft (plunger) when the handle is in the locked position. The placard also presents a diagram showing how the arm and shaft should be positioned. A red push-button switch near the window turns on a lamp inside the door, which illuminates the area observable through the window. If the arm is properly positioned around the shaft, proceed to check the orange stripe on each of the six rotary latches (three on each side of the airstair door) and ensure each is aligned with the notch in the plate on the door frame. Finally, turn the battery switch ON and check the warning annunciator panel in the cockpit; ensure that the red DOOR UNLOCKED annunciator is extinguished. It will illuminate when the battery switch is ON and the airstair door is not closed and securely latched. With the battery switch OFF and the airstair door closed but not latched, the DOOR UNLOCKED annunciator will illuminate. If any condition specified in this door-latching procedure is not met, DO NOT TAKE OFF.

2.10.2 Cargo Door

A large, swing-up cargo door, hinged at the top, provides access for the loading of large items. The cargo door latch system is operated by two handles: one in the upper aft area of the door, and the other in the lower forward area of the door. Two separate access covers must be opened in order to operate the two handles. In order to move the upper aft handle out of the latched position, depress the black release button in the handle and rotate the yellow handle upward as far as it will go. This movement is transmitted via cables to two hollow, crescent latches on the forward side and two on the aft side of the cargo door. The latches rotate to release latch posts mounted in the cargo door frame.

In order to move the lower latch handle out of the CLOSED position (forward), lift the orange lock hook from the stud on the yellow latch handle, and rotate the handle aft as far as it will go. This movement is transmitted via linkage to four latch pins on the bottom of the cargo door. The pins move aft to disengage latch lugs mounted at the bottom of the cargo door frame.



After unlatching the bottom latch pins, close the forward latch handle access cover. If this cover is left open, it will rotate on its hinge until a portion of it extends below the bottom of the cargo door when the cargo door is opened. Then, when the cargo door is subsequently closed, the access cover will be broken.

To open the cargo door after it is unlatched, push out on the bottom of the door. After the cargo door is manually opened a few feet, gas springs take over and raise the door to the fully open position.

To close the cargo door, pull it down and inboard. The gas springs will resist the closing effort until the door is only open a few feet. Then, as the springs move over center, they begin applying a closing force to the door.

An inflatable rubber seal is installed around the perimeter of the cargo door, and seats against the door frame when closed. When the cabin is pressurized, air seeps into the rubber seal through small holes in the outboard side of the seal. The higher the cabin differential pressure, the more the seal inflates. This is a passive-seal system and has no mechanical connection to a bleed air source.

There are no latch handles on the outside of the cargo door, so it can be opened and closed from inside the airplane only.

To latch the cargo door after it is closed, rotate the lower forward latch handle forward until the orange lock hook engages the stud on the handle. Check the security of this handle by attempting to move it aft without raising the lock hook; it should not move. Close the access cover. Next, check the observation window at the lower aft corner of the cargo door. Ensure that the orange stripe on the latch pin linkage is aligned with the orange pointer in the observation window.

Next, rotate the upper aft latch handle down until the black release button pops up. Check the security of this handle by attempting to pull it out and up without depressing the release button; it should not move. Close the access cover. Then, ensure that the orange stripe on each of the four rotary latches (two on each side of the cargo door) is aligned with the notch in the plate on the door frame. Finally, check the warning annunciator panel in the cockpit and ensure that the red DOOR UNLOCKED annunciator is extinguished. With the battery switch ON, it will be illuminated if either the airstair door or the cargo door is open. With the battery switch OFF, it will be illuminated only if the airstair door is closed but not securely latched. Perform the Airstair Door/Cargo Door Circuitry Check in Chapter 7, Shore-Based Procedures, prior to the first flight of the day. If any condition specified in this door-latching procedures is not met, DO NOT TAKE OFF.

2.10.3 Emergency Exits

The emergency exit doors are located on the left and right side of the fuselage at the forward ends of the passenger compartment. From the inside, the doors are released with a pull-down handle, placarded EXIT-PULL. From the outside, the doors are released with a flush-mounted, pull-out handle. The nonhinged, plug-type doors can be removed completely from the frame into the cabin when the latches are released.

The doors can be locked so that they cannot be removed or opened from the outside using the flush-mounted pull-out handle. The doors are locked when the lock-levers (inside) are in the down or locked position. Locking the doors is for security when the airplane is parked. The lock-levers should be in the up or unlocked position prior to flight, to allow removal of the doors from the outside in the event of an emergency. Removal of the doors from the inside is possible at all times using the EXIT-PULL handles, since these handles are not locked by the lock-levers. Exit lock placards are placed on the lock-levers so that they can be read when the levers are in the locked position.

2.11 SUN VISORS

1. To Operate From Stowed Position:

Push straight back and allow to rotate down. Move along track to desired place and pivot out near windshield (or window), rotate knob clockwise to lock.

2. To Change Position:

Rotate knob counterclockwise to unlock, move to desired location and position, then relock knob by turning clockwise.

3. To Stow:

Rotate knob counterclockwise to unlock, move along track to recessed area of headliner, pivot up and press forward to allow catch to retain sun visor assembly.

2.12 CONTROL LOCKS

Install the control locks in the following sequence:

- 1. Position the U-clamp around the engine control levers.
- 2. Move the control column as necessary to align the holes, then insert the L-shaped pin that is attached to the middle of the chain (approx). The control wheel position: full forward and rotated approximately 15° to the left.

3. Insert the L-shaped pin (attached to the end of the chain) through the hole provided in the floor aft of the rudder pedals. The rudder pedals must be centered to align the hole in the rudder bellcrank with the hole in the floor. The pin is then inserted until the flange is resting against the floor. This will prevent any rudder movement.

WARNING

Before starting engines, remove the control locks by reversing the preceding procedure. Failure to remove the control locks will result in no control of the ailerons, elevators, and rudder.



Remove the control locks before towing the airplane. If towed with a tug while the rudder lock is installed, serious damage to the steering linkage can result.

2.13 ENGINES

The UC-12W is powered by two Pratt & Whitney Canada PT6A-60A Turboprop Engines (Figure 2-10). The PT6A-60A is a reverse-airflow engine.

2.13.1 Propulsion System Controls

The propulsion system is operated by three sets of controls; the power levers, propeller levers, and condition levers. The power levers serve to control engine power. The condition levers control the flow of fuel at the fuel control outlet and select fuel cutoff, low idle and high idle functions. The propeller levers are operated conventionally and control the constant speed propellers through the primary governor. Refer to Figure 2-11.

Figure 2-10. PT6A-60A Turboprop Engines

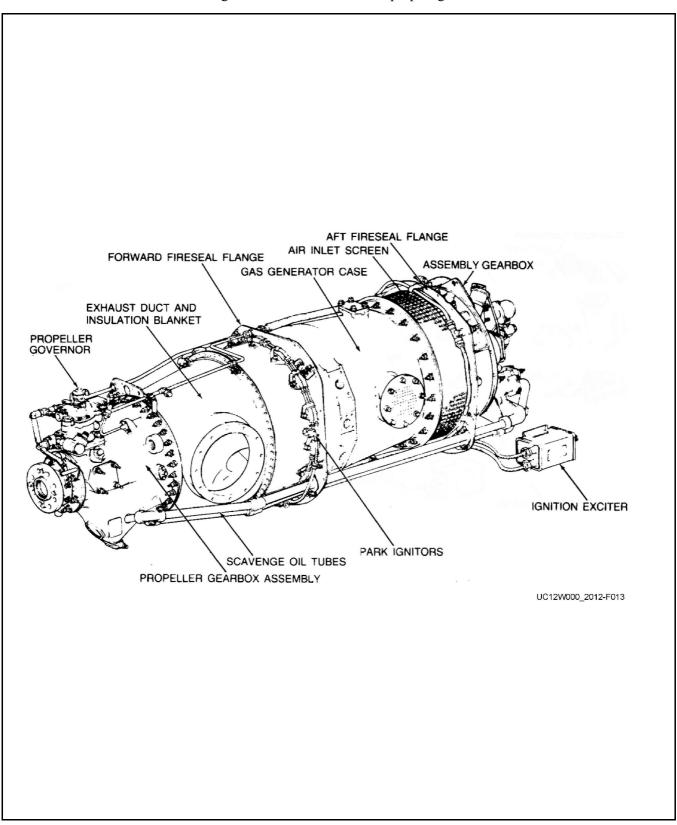
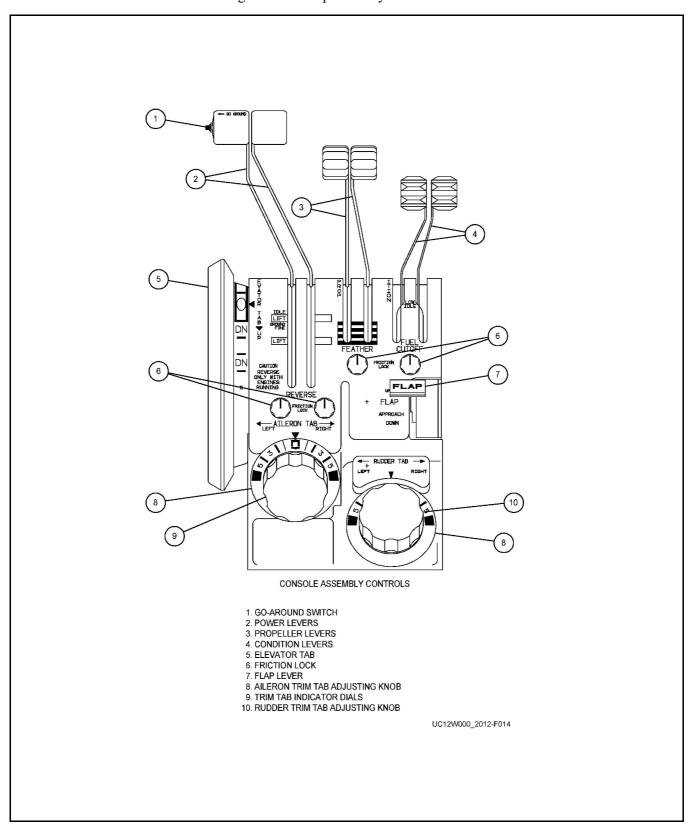


Figure 2-11. Propulsion System Controls



2.13.1.1 Power Levers

The power levers provide control of engine power from idle through take-off power by operation of the gas generator (N_1) governor in the fuel control unit. Increasing N_1 rpm results in increased engine power.

2.13.1.2 Propeller Ground Fine Operation

The propeller ground fine operation is used to provide optimum deceleration on the ground during landing by taking advantage of the maximum available propeller drag.

Ground fine operation is accomplished by a gate position for the power levers in the pedestal. The power levers must be retarded below the IDLE gate by raising them over the gate and retarding the levers to the GROUND FINE gate.



Power levers should not be moved to the GROUND FINE position when the engines are not running as this will cause damage to the system.

2.13.1.3 Propeller Reversing

When the power levers are lifted over the IDLE gate, they control engine power through the GROUND FINE and REVERSE ranges.



Propeller reversing on unimproved surfaces should be accomplished carefully to prevent propeller erosion from reversed airflow and, in dusty or snowy conditions, to prevent obscuring the operator's vision.

Condition levers, when set at HIGH IDLE, keep the engines operating at 70% N_1 (minimum) for maximum reversing performance.



Power levers should not be moved into the reversing position when the engines are not running as this will cause damage to the reversing system.

2.13.1.4 Propeller Levers

Each propeller lever adjusts the propeller governor, which results in an increase or decrease of propeller rpm. For propeller feathering, each propeller lever releases high pressure oil from the propeller allowing the counterweights and feathering spring to change the pitch. Detents at the rear of lever travel prevent inadvertent movement into the feathering range. In flight, the operating range is 1,450 to 1,700 rpm.

2.13.1.5 Condition Levers

The condition levers have three positions; FUEL CUTOFF, LOW IDLE and HIGH IDLE. Each lever controls the fuel cutoff function of the fuel control unit and limits idle speed at 62% N₁ minimum for low idle, and 70% N₁ minimum for high idle.

2.13.1.6 Friction Locks

Four friction locks are located on the power quadrant of the pedestal.

2.13.2 Engine Indicating System (EIS)

The EIS digitizes airplane engine data for input to the avionics system while converting avionics digital data into outputs that drive airplane annunciators and aural horns.

The EIS consists of four Data Concentration Units (DCUs). Two units wired as DCUs and two units wired as Engine Data Concentrators (EDCs).

The DCUs transfer airplane sensor information (analog fuel flow, strut status, etc.) to the IAPS concentrators while transferring caution/warning advisory information from the Flight Control Computers to the annunciators. The EDUs also provide redundant engine data to the displays.

2.13.3 Engine Instrumentation

Engine instrument design has incorporated currently approved green, yellow and red operating ranges and monitor time limits of each range to give the pilot a visual indication of engine parameters as they change. Refer to Figure 2-12.

Engine instruments are provided on the MFD at the top of the display (Figure 2-12). In the event of an MFD failure, the selection of the reversionary switch to PFD will place the following engine instruments at the top of the pilot and copilot PFD:

- 1. The ITT indicators.
- 2. The torquemeters.
- 3. The N_2 (propeller) tachometers.
- 4. The N_1 (gas generator) tachometers.
- 5. The fuel flow indicators.
- 6. The oil temperature/oil pressure indicators.

A propeller synchroscope is located in the upper right corner of the MFD, directly below the oil temperature digits. The synchroscope will translate to the right if the right engine is running faster and likewise to the left if the left engine is running faster. A series of non-moving white squares should be visible if the propellers are in sync.

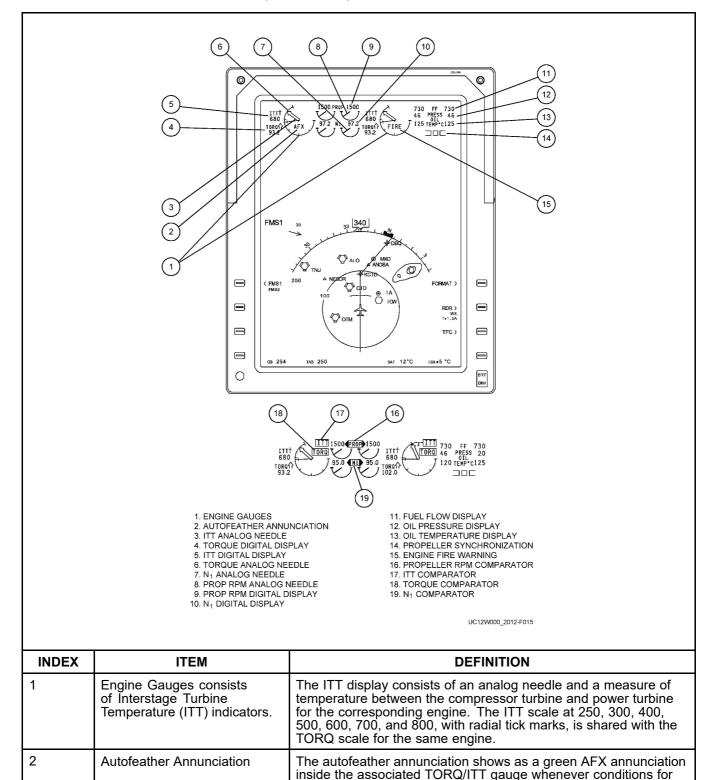
2.13.4 Engine Warning Tones System

The Rockwell Collins Pro Line 21 is a fully integrated aircraft avionics system. The Rockwell Collins configurable display options to the Pro Line 21 avionics system provides discrete trip outputs for the following engine parameters:

- 1. N1 Gas Generator Speed.
- 2. Torque.
- 3. ITT.
- 4. Propeller RPM

These discrete outputs are wired to the aural warning generator that provides aural tones via the aircraft's flight deck audio system (headsets and cockpit speaker). An aural tone will sound when any one of the engine parameters exceed a pre-defined cautionary limit and a pre-defined warning limit. Each engine parameter type can sound the aural tone. There is no distinction in the aural tone between the left or right engine and each engine parameter. The only distinction is whether the audio advisory is cautionary or warning in nature. The aural tones and the engine parameter values that trip it are defined in Figure 2-13.

Figure 2-12. Engine Instrumentation



system arming are met.

Figure 2-12. Engine Instrumentation (cont.)

INDEX	ITEM	DEFINITION
3	ITT Analog Needle	The ITT analog needle shows left and right side engine ITT in degrees Celsius.
4	Torque Digital Display	The on-side engine torque values show digitally to the left of each gauge.
5	ITT Digital Display	The ITT shows to the left of each gauge. ITT is measured in degrees Celsius.
6	Torque Analog Needle	The torque analog needles show the left and right side engine torque. The torque gauge has grey tick marks that represent 0, 200, 600, 1,000, 1,400, 1,800 foot-pounds of torque. The redline indication is a red radial tick mark at 2,230 foot-pounds torque redline.
7	N ₁ Analog Needle	The N_1 analog needle shows the left and right side engine gas compressor speed. N_1 shows as a percentage of maximum allowable speed.
8	N₁ Digital Display	The N ₁ values show digitally above each gauge.
9	Propeller RPM Analog Needles	The propeller rpm analog needles show the left and right side propeller rotation speed. The PROP scale has a white tick mark located at the position that corresponds to 1,900 rpm.
10	Propeller RPM Digital Display	The PROP values show digitally above each gauge.
11	Fuel Flow Display	The FF display line digitally shows left and right engine fuel flow rate. The FF value shows in pounds per hour (pph). Can be changed to Kilograms Per Hour (KPH).
12	Oil Pressure Display	The OIL PRESS display line digitally shows left and right engine oil pressure. The OIL PRESS value shows in pounds/square inch (psi).
13	Oil Temperature Display	The OIL TEMP display line digitally shows left and right engine oil temperature. The OIL TEMP value shows in degrees Celsius.
14	Propeller Synchronization	The propeller synchronization display, called the propeller synchroscope, shows as a moving string of squares. The squares move toward the engine that has the higher propeller speed.
15	Engine Fire Warning	The engine fire warning shows as a red FIRE annunciation inside the associated TOR/ITT gauge.
16	Propeller RPM Comparator	The PROP comparator annunciator is located between the propeller RPM scales. The PROP comparator (yellow boxed PROP) shows when the difference between the EDC and DCU inputs exceeds tolerance. The PROP comparator flashes for 5 seconds when the miscompare condition first exists, then steady.
17	ITT Engine Comparator	The ITT engine comparator annunciators are located above the respective engine TORQ/ITT scale. The ITT engine comparator (yellow boxed ITT) shows when the difference between the EDC and DCU inputs exceeds tolerance. The ITT engine comparator flashes for 5 seconds when the miscompare condition first exists, then steady.
18	Torque Comparator	The TORQ engine comparator annunciators are located above the respective engine TORQ/ITT scale. The TORQ engine comparator (yellow boxed TORQ) shows when the difference between the EDC and DCU inputs exceeds tolerance. The TORQ engine comparator flashes for 5 seconds when the miscompare condition first exists, then steady.

Figure 2-12. Engine Instrumentation (cont.)

INDEX	ITEM	DEFINITION
19	N₁ Engine Comparator	The N_1 engine comparator annunciator is located between the engine N_1 scales. The N_1 engine comparator (yellow boxed N_1) shows when the difference between the EDC and DCU inputs exceeds tolerance. The N_1 engine comparator flashes for 5 seconds when the miscompare condition first exists, then steady.

These parameters are chosen to alert crews of transient and exceedance conditions as a source of additional information to the EIS indications for situation awareness. A mute function is available for the transient tone only to allow crews to acknowledge the condition and continue operation up to the published AFM time limit corresponding to that condition.

A switch and a button are installed on the lower center instrument panel (Figure 2-14). The corresponding functions are defined per Figure 2-15.

Figure 2-13. Aural Tones

		Engine Parameter Trip Points			
Aural Advisory	Aural Tone	ITT	Torque	Prop RPM	N1 Speed
Transient Tone (Caution)	Repetitive 430 Hz Tone	823 °C	102%	1,760	_
Exceedance Tone (Warning)	Repetitive 3,000 Hz Tone	850 °C	156.0%	1,870	104%

Notes:

- 1. Due to parameter accuracy/resolution and steady state fluctuations, these tones may sound just prior to the EIS indications on the PFD/MFD becoming amber (engine caution indication) in color or red (engine warning indication) in color.
- 2. If the engine parameter that triggered the Transient Tone continues to rise, the aural advisory tone will transition to the Exceedance Tone.
- 3. The Torque tone is based solely on the numerical torque value limit (102% and 156%) as shown in the basic B-300 AFM and will not enunciate for any of the values that are time limited unless that value exceed 102% (transient) or 156% (exceedance).
- 4. ITT Transient tone of 823 °C correspond to the TAKEOFF, MAX CONT and MAX CRUISE value of 820 °C in the basic B-300 AFM and coincide with the YELLOW indication on the EIS with a buffer to prevent nuisance alerts
- 5. Prop speed of 1,760 RPM is set to provide an indication of primary governor failure.

2.13.5 Engine Trend Monitor

The Digital Aircraft Data Acquisition System Plus (ADAS^d) has been developed to provide the aircraft owner and/or operator with engine and airframe operational data. The ADAS^d is a recording device and event monitor. It is designed as a tool for the maintenance staff and owner to monitor the overall health of the aircraft as well as to document any abuse while in service. The system records the date, time, duration, maximum value and average value of any exceedance. It counts cycles, records flight times, identifies and measures hot starts and records the maximum value observed by each sensor during flight. The system will also perform the data collection requirement of the P&WC ECTM® trending program.

Figure 2-14. System Controls (Typical)

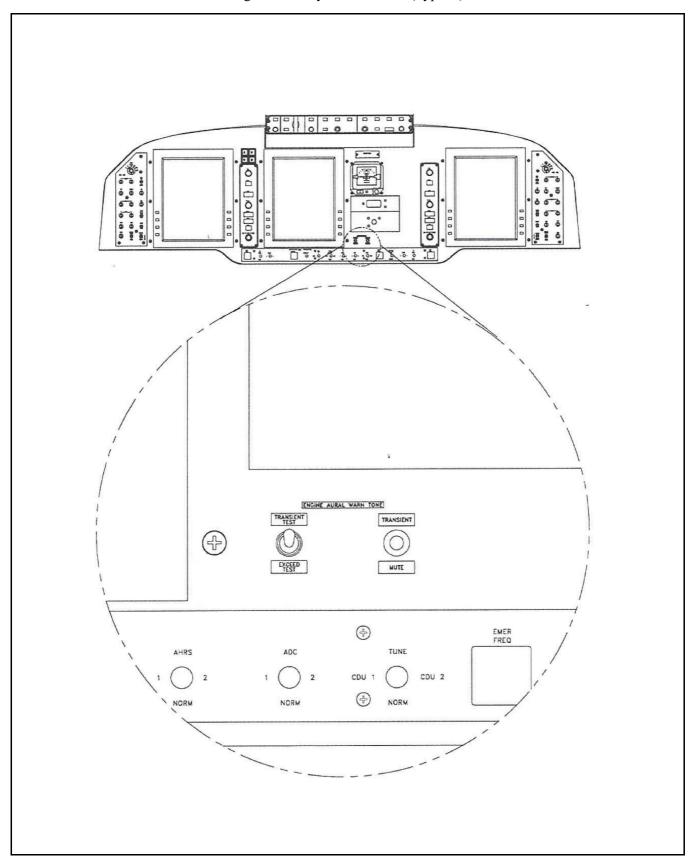


Figure 2-15. System Switches

SWITCH		FUNCTIONS
Test	Transient	Test Repetitive 430 Hz Tone
	Exceed	Test Repetitive 3,000 Hz Tone
Transient Mute		Silence Transient Tone Only

The ADAS^d engine monitoring system does not function as the sole source of engine operating data required by the FAA approved operating specifications or maintenance program. The ADAS^d engine monitoring systems intended use is to provide optional information only.

With the exception of the TREND switch/fault lamp, the ADAS^d has no interface with the aircraft pilot or crew. Communication with the system processor is done using a WindowsTM based computer and Pratt & Whitney Engine Services, Inc. Monitor Link Program (MLP). All features of the Pratt & Whitney Engine Services, Inc. system are set using MLP. A complete description of the capabilities of MLP and detailed instructions on its use can be found in the Pratt & Whitney Engine Services, Inc. MLP Users Guide.

Required engine maintenance, as prescribed in the applicable airframe or engine Instructions for Continued Airworthiness, shall not be predicated on the data obtained from the Pratt & Whitney Engine Services, Inc. engine monitoring/recording system.

Because the ADAS^d may be programmed with engine operating limits different from those in the Aircraft Flight Manual, the aircraft's existing engine instruments shall be used to ensure that the engine is operated within the limits specified in the Aircraft Flight Manual, and shall also be used to identify exceedances of the limits.

2.13.6 Engine Lubrication System

Engine oil, contained in an integral tank between the engine air intake and the accessory case, cools as well as lubricates the engine. An oil radiator located inside the lower nacelle keeps the engine oil temperature within the operating limits.

The lubrication system capacity per engine is 14 U.S. quarts or 3.5 U.S. gallons (13.2 liters). The drain and refill quantity is approximately 11 U.S. quarts (10.4 liters) with 5 U.S. quarts (4.7 liters) measured on the dipstick for adding purposes.

2.13.7 Magnetic Chip Detector

A magnetic chip detector is installed in the bottom of each engine nose gearbox. This detector will activate an amber annunciator, L CHIP DETECT or R CHIP DETECT, to alert the pilot of possible metal contamination in the engine oil supply. Illumination of a CHIP DETECT annunciator is not in itself cause for an engine to be shut down. Engine instruments should be monitored for abnormal indications. If parameters are abnormal, a precautionary shutdown may be made at the pilots discretion. After illumination of a CHIP DETECT annunciator, cause of the malfunction should be determined and corrected prior to the next flight.

2.13.8 Starting and Ignition System

Each engine is started by a three-position switch located on the Left Subpanels (Figure 2-4), placarded IGNITION AND ENGINE START - LEFT - RIGHT - ON - OFF - STARTER ONLY. Moving the switch upward to the ON position activates both the starter and ignition, and the appropriate green IGNITION ON annunciator will illuminate. The starter drive action is stopped by placing the switch in the center OFF position. The STARTER ONLY position is used to motor the engine without ignition.

2.13.9 Ice Protection

2.13.9.1 Engine Air Inlet

Engine exhaust heat is utilized for heating the engine air inlet lips. Hot exhaust, picked up by a scoop inside the left exhaust stack is ducted to the inlet lip. Exhaust flows through the inside of the lip and out through the right exhaust stack. The system operates whenever the engine is running.

2.13.9.2 Engine Anti-Ice System

An inertial separation system is built into each engine air duct to prevent moisture particles from entering the engine inlet plenum under icing conditions. The system includes dual actuators and controls. The system is monitored by green L and R ENG ANTI-ICE and amber L and R ENG ICE FAIL annunciators. Illumination of the L and R ENG ANTI-ICE annunciators indicates that the system is actuated. Illumination of the L or R ENG ICE FAIL annunciators indicates that the system did not operate to the desired position. Immediate illumination of the L or R ENG ICE FAIL annunciator indicates loss of electrical power, whereas delayed illumination indicates an inoperative actuator. In either event, the STANDBY actuator should be selected.

2.13.10 Auto Ignition

The auto ignition system provides automatic ignition to prevent engine loss due to combustion failure. This system is provided to ensure ignition during turbulence, and penetration of icing or precipitation conditions.

2.13.11 Engine Compartment Fire Detection System

The fire detection system is designed to provide an immediate warning in the event of fire in either engine compartment. The system consists of a temperature sensing cable for each engine; two red warning annunciators (located within the glareshield eyebrow in the firewall fuel shutoff valve switches to the left and right of the warning annunciator panel) placarded L and R ENGINE FIRE; two test switches on the Right Subpanels (Figure 2-5), and two circuit breakers on the Right Circuit Breaker Panel (Figure 2-22), placarded FIRE DETR. When the fire has been extinguished (if the integrity of the system has not been destroyed), the system will reset itself.

The test switches, on the Right Subpanels (Figure 2-5), are placarded ENG FIRE TEST; DET, OFF, EXT; and LEFT and RIGHT. When either of the switches is placed in the DET position, the corresponding ENG FIRE annunciator along with the flashing MASTER WARNING annunciator will illuminate and a red annunciation of FIRE is visible in the ITT/TORQUE indicator for either engine on the MFD. The system may be tested anytime, either on the ground or in flight.

2.13.12 Engine Compartment Fire Extinguisher System

The system is powered by the LEFT and RIGHT ENG FIRE EXT circuit breakers located on the Left Circuit Breaker Panel (Figure 2-21). The firewall fuel shutoff valve switches are powered by the two FIREWALL VALVE circuit breakers located on the Left Circuit Breaker Panel (Figure 2-21).

The system incorporates two sets of annunciator switches for each side of the system. The fire extinguisher switches placarded EXTINGUISHER PUSH and DISCHARGED are in the glareshield eyebrow to the left and right of the firewall fuel shutoff valve switches. The firewall fuel shutoff valve switches are placarded F/W VALVE PUSH and contain the ENG FIRE and CLOSED annunciators. These switches are located next to the fire extinguisher switches.

When either of the ENG FIRE annunciators illuminate and a red annunciation of FIRE is visible in the ITT/TORQUE indicator for either engine on the MFD, the plastic guard over the switch should be lifted and the switch depressed. When the switch is depressed, the CLOSED and the EXTINGUISHER PUSH annunciators will illuminate. This indicates the firewall valve for that side is closed and the extinguisher for that side is armed. To discharge the extinguisher, raise the plastic cover (this cover is safetied) from the face of the fire extinguisher switch (illuminated EXTINGUISHER PUSH) and depress the switch. This will completely discharge the appropriate fire extinguisher cylinder and the DISCHARGED annunciator will illuminate. This annunciator will remain illuminated (regardless of the position of the battery switch) until the expended cylinder has been replaced.

The test switches on the Right Subpanels (Figure 2-5) are placarded ENG FIRE TEST; DET, OFF, EXT; and LEFT and RIGHT. When either of the switches is placed in the EXT position, the corresponding EXTINGUISHER PUSH and DISCHARGED annunciators should illuminate. The system may be tested anytime, either on the ground or in flight.

2.14 PROPELLER SYSTEM

2.14.1 Description

Each engine is equipped with a conventional four-blade, full-feathering, constant-speed, counter-weighted, reversing, variable-pitch propeller mounted on the output shaft of the reduction gearbox. The propeller pitch and speed are controlled by engine oil pressure, through single-action, engine-driven propeller governors. Centrifugal counterweights, assisted by a feathering spring, move the blades toward the low rpm (high pitch) position and into the feathered position. Governor boosted engine oil pressure moves the propeller to the high rpm (low pitch) hydraulic stop and reverse position. The propellers have no low rpm (high pitch) stops; this allows the blades to feather after engine shutdown.

Propeller tie-down boots are provided for use on the moored airplane to prevent windmilling at zero oil pressure.

2.14.2 Low Pitch Stops

The propeller control systems are equipped with flight idle and ground idle low pitch stops. The flight idle low pitch stop is a mechanically actuated hydraulic stop. The ground idle low pitch stop is an electrically actuated stop controlled by a solenoid, which resets the governor beta valve to produce the desired blade angle. Power is normally removed from the ground idle low pitch solenoid when the right squat switch is activated at liftoff. If a failure occurs in the system during flight such that one or both of the ground idle low pitch solenoids are receiving 28 volts for more than 10 seconds, the amber PROP GND SOL annunciator will illuminate. With power supplied to a ground idle low pitch solenoid, the pitch of the associated propeller will continue to decrease from the flight idle stop to the ground idle stop when the propeller is no longer controlled by the governor, causing an increase in disking drag and a yawing moment if only one propeller is affected. Power can normally be removed from the solenoids by pulling the PROP GOV TEST circuit breaker located on the Right Circuit Breaker Panel (Figure 2-22). If this removes power from the solenoids, the PROP GND SOL annunciator will extinguish. During ground operations the PROP GND SOL annunciator is inhibited by the left squat switch.

The white L or R PROP PITCH annunciators are provided to inform the pilot of a blade angle more than 8° below the flight idle low pitch stop. The difference between the flight idle and ground idle blade angles is approximately 10° . Therefore, in normal ground operation, these annunciators will be illuminated. The blade angles will be automatically reset from the ground idle low pitch stop to the flight idle low pitch stop as the power levers are advanced above 68 - 70% N₁ speed, and the L and R PROP PITCH annunciators will extinguish.

2.14.3 Propeller Governors

Two governors, a constant speed governor and an overspeed governor, control the propeller rpm. The constant speed governor controls the propeller through its entire range. The propeller control lever controls the rpm of the propeller by means of this governor. If the constant speed governor should malfunction and prop RPM exceeds 1,700 rpm, the overspeed governor releases oil from the propeller to keep the rpm from exceeding approximately 1,768 rpm.

2.14.4 Autofeather System

The automatic feathering system provides a means of immediately dumping oil from the propeller servo to enable the feathering spring and counterweights to start the feathering action of the blades in the event of an engine failure.

Green AFX annunciators are displayed in the ITT/TORQUE indicator for each engine on the MFD. Illumination of this annunciation indicates the respective system is armed and that the power lever is advanced above 90% N₁.

An amber AUTOFTHER OFF annunciator in the caution/advisory/status annunciator panel, will illuminate whenever the autofeather system is not armed and the landing gear is extended.

2.14.5 Propeller Synchrophaser

The propeller synchrophaser system is an electronic system certified for all operations including takeoff and landing. The system automatically matches the RPM of both propellers and positions the propellers at a preset phase relationship in order to reduce cabin noise.

Before engaging the system, manually set the RPM of each engine to within 10 RPM of each other. When the prop sync switch is turned on, engagement will automatically occur when the relative phase angle of the propellers is within 30° of the preset angle. When the system engages, both propeller speeds are increased by one-half the holding range of the system. To maintain synchronization, the system increases the RPM of the slower propeller and simultaneously reduces the RPM of the faster propeller. The system will never reduce RPM below that selected by the propeller control lever.

To change RPM with the system ON, adjust both propeller controls by the same amount. If the synchrophaser is ON but does not maintain synchronization, the system has reached the end of its range. Increasing the setting of the slow propeller, or reducing the setting of the fast propeller, will bring the speeds within the limited synchrophaser range. If preferred, the synchrophaser switch may be turned OFF, the propellers re-synchronized manually, and the synchrophaser turned back ON.

2.15 FUEL SYSTEM

The aircraft fuel system (Figure 2-16) consists of two separate main fuel systems connected by a valve-controlled crossfeed line. The aircraft is also equipped with two supplemental fuel systems: two extended range fuel tanks and two auxiliary fuel tanks. The main systems have a total of 380 gallons of usable fuel. The auxiliary fuel tanks contain a total of 159 gallons of usable fuel and the extended range tanks contain a total of 236 gallons of usable fuel.

When the extended range tanks are filled, they will be used first. During transfer of extended range fuel, the auxiliary tanks and nacelle tanks are maintained full. A check valve in the gravity feed line from the outboard wing prevents reverse fuel flow from the nacelle tank. When all usable fuel in the extended range tank is transferred, a float switch, located toward the aft end of the tank, actuates and supplies power to a 30-second time-delay relay. This relay closes the extended range motive flow valve, and opens the valves associated with the auxiliary fuel tank. Upon exhaustion of the extended range fuel tank and auxiliary fuel tank, a float switch located in the auxiliary fuel tank will send a signal to close all valves associated with fuel transfer. Normal gravity transfer of the main wing fuel into the nacelle tanks will then begin.

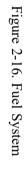
2.15.1 Fuel Pumps

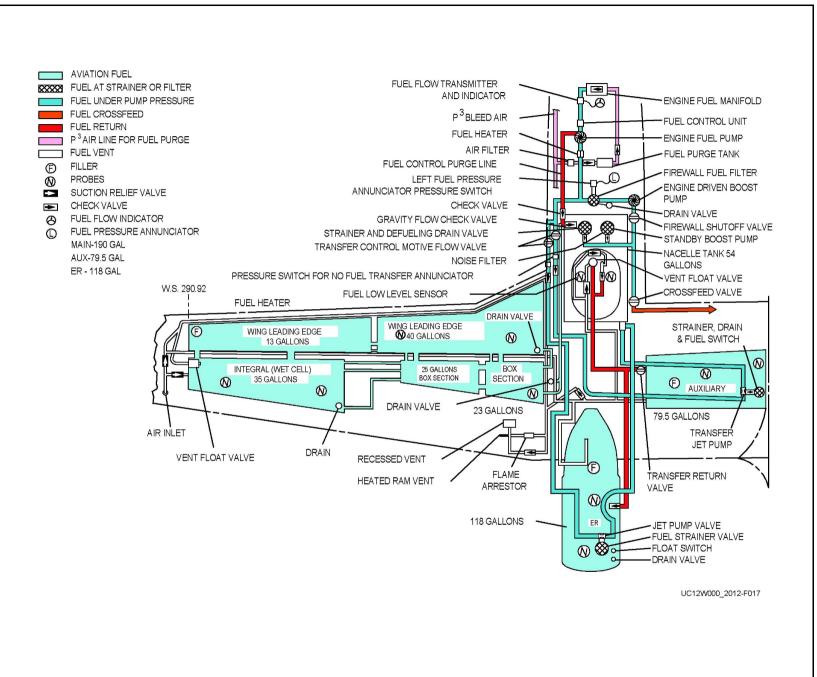
The engine driven fuel pump (high pressure) is mounted on the accessory case in conjunction with the fuel control unit. Failure of this pump results in an immediate flameout. The primary boost pump (low pressure) is also engine driven. This pump operates when the gas generator (N_1) is turning and provides sufficient fuel pressure to the high pressure pump for all flight conditions except operation with aviation gasoline above 20,000 feet altitude, and operation with crossfeed.

An electrically driven standby fuel pump (low pressure) performs three functions; as backup pump for use in the event of a primary fuel boost pump failure, with aviation gasoline, and for crossfeed operations. In the event of an inoperative standby fuel pump, operation on aviation gasoline is prohibited and crossfeed can only be accomplished from the side of the operative pump.

Electrical power to operate the standby fuel pumps is controlled by lever lock toggle switches, placarded STANDBY PUMP - ON - OFF, located on the fuel control panel.

In the event of a primary boost pump failure, the respective red FUEL PRES LO annunciator in the annunciator panel will illuminate. This annunciator illuminates with pressure decreases below 10 ± 1 psi. The annunciator will be extinguished by switching on the standby fuel pump on that side, thus increasing pressure above 11 ± 2 psi.







Engine operation with the fuel pressure annunciator ON is limited to 10 hours between overhaul, or replacement of the engine driven fuel pump.

When using aviation gasoline, during climbs above 20,000 feet, the first indication of insufficient fuel pressure will be an intermittent flicker of the FUEL PRES LO annunciators. A wide fluctuation of the fuel flow indicator may also be noted. These conditions can be eliminated by turning on the standby fuel pump.

2.15.2 Extended Range Fuel Tank Fuel Transfer System

The extended range fuel tank transfer system automatically transfers fuel from the extended range fuel tank to the nacelle tank without pilot action (provided the XFR OVERRIDE switch is in the AUTO position). Transfer occurs when there is fuel in the extended range fuel tank, there is engine fuel pressure, and engine ignition is off. Fuel pressure from the engine-driven boost pump provides the motive flow to drive the jet pump. When the XFR OVERRIDE switch on the fuel control panel is in the AUTO position, the motive flow valve is controlled by the automatic fuel transfer module and the additional relay logic incorporated with the extended range system. The motive flow valve and check valve for the extended range fuel tank are located along the outboard side of the nacelle. When the conditions are met the motive flow valve is energized open, and fuel pressure is supplied to the jet pump located inside the extended range fuel tank. The fuel is then transferred from the extended range fuel tank to the nacelle fuel tank. In the automatic mode, when the extended range fuel tank empties, electrical contacts in the float switch in the extended range fuel tank will close, supplying power to a time-delay relay. The relay closes the extended range motive flow valve and opens the valves associated with the auxiliary fuel tank. Fuel transfer then begins to take place from the auxiliary fuel tank into the nacelle fuel tank.

If extended range tank fuel transfer stops while fuel remains in the extended range fuel tank, the L or R NO FUEL XFR annunciator will illuminate. It is normal for fuel transfer to stop when the FUEL PRES LO annunciator or the L or R IGNITION ON annunciator is illuminated or when the engine is being crossfed. A pressure switch set to actuate at 6 ± 1 psi is installed in the fuel line between the motive flow valve and the check valve. If the pressure switch fails to close and there is fuel in the extended range fuel tank, the NO FUEL XFR annunciator on the caution/advisory/status annunciator panel will illuminate to indicate the motive flow valve is closed. Positioning the XFR OVERRIDE switch to the ER position bypasses the automatic fuel transfer module and the additional relay logic incorporated with the extended range system, and applies power directly to the motive flow valve, energizing it to the open position. If the NO FUEL XFR annunciator remains illuminated, the motive flow valve has failed and no fuel transfer from the extended range fuel tank will be possible. Once the motive flow valve opens, the jet pump will pump fuel from the extended range fuel tank into the nacelle fuel tank. When the XFR OVERRIDE switch is in the ER position and the extended range fuel tank is empty, the XFR OVERRIDE switch must be manually positioned to the AUTO position to return control to the automatic fuel transfer module, or to the AUX position to command fuel to be supplied from the auxiliary fuel tank. When the XFR OVERRIDE switch is in the AUTO position and the extended range fuel tank is empty, the automatic fuel transfer module and the additional relay logic incorporated with the extended range system will simultaneously remove power and close the extended range motive flow valve, preventing continued operation of the jet pump. The jet pump will not be damaged by operation after the tank is empty, but extended operation with an empty fuel tank may draw unnecessary moist air into the main fuel system from the empty, vented extended range fuel tanks.

The extended range fuel system will not feed into the main fuel system if there is a failure of both boost pumps (engine-driven and electrical) or a failure of the extended range motive flow valve. This condition will be noted by the illumination of the NO FUEL XFR annunciator on the caution/advisory/status annunciator panel. The NO FUEL XFR annunciator will illuminate when fuel pressure is less than 6 ± 1 psi at the extended range pressure switch and the extended range float switch is not in the empty position or when fuel pressure is less than 6 ± 1 psi at the auxiliary fuel tank pressure switch and the auxiliary fuel tank float switch is not in the empty position.

2.15.3 Auxiliary Tank Fuel Transfer System

The auxiliary fuel tank transfer system automatically transfers fuel from the auxiliary fuel tank to the nacelle tank without pilot action (provided the XFR OVERRIDE switch is in the AUTO position). Transfer occurs when there

is no fuel in the extended range fuel tank, fuel in the auxiliary fuel tank, there is engine fuel pressure, and engine ignition is off. Fuel pressure from the engine-driven boost pump provides the motive flow to drive the jet pump. When the XFR OVERRIDE switch on the fuel control panel is in the AUTO position, the motive flow valve and return valve are controlled by the automatic fuel transfer module and the additional relay logic incorporated with the extended range system. The motive flow valve for the auxiliary fuel tank is located along the side of the nacelle. The return valve for the auxiliary fuel tank is located in the wheel well. When the conditions are met the motive flow valve and return valve are energized open, and fuel pressure is supplied to the jet pump located inside the auxiliary fuel tank. The fuel is then transferred from the auxiliary fuel tank to the nacelle fuel tank. In the automatic mode, when the auxiliary fuel tank empties, electrical contacts in the float switch in the auxiliary fuel tank will close, supplying a signal to the automatic fuel transfer module. Power is removed from the auxiliary motive flow valve and return valve, causing them to close. When this occurs, normal gravity transfer of the main wing fuel into the nacelle tanks will then begin.

If auxiliary tank fuel transfer stops while fuel remains in the auxiliary fuel tank, the L or R NO FUEL XFR annunciator will illuminate. It is normal for fuel transfer to stop when the FUEL PRES LO annunciator or the L or R IGNITION ON annunciator is illuminated or when the engine is being crossfed.

A pressure switch set to actuate at 6 ± 1 psi is installed in the fuel line between the motive flow valve and the check valve. If the pressure switch fails to close and there is fuel in the auxiliary fuel tank, the NO FUEL XFR annunciator on the caution/advisory/status annunciator panel will illuminate to indicate the motive flow valve is closed. Positioning the XFR OVERRIDE switch to the AUX position bypasses the automatic fuel transfer module and the additional relay logic incorporated with the extended range system, and applies power directly to the motive flow valve and return valve, energizing them to the open position. If the NO FUEL XFR annunciator remains illuminated, the motive flow valve has failed and no fuel transfer from the auxiliary fuel tank will be possible. Once the motive flow valve and return valve have opened, the jet pump will pump fuel from the auxiliary fuel tank into the nacelle fuel tank. When the XFR OVERRIDE switch is in the AUX position and the auxiliary fuel tank is empty, the XFR OVERRIDE switch should be manually positioned to the AUTO position. When the XFR OVERRIDE switch is in the AUTO position and the auxiliary fuel tank is empty, the automatic fuel transfer module will simultaneously remove power and close the auxiliary motive flow valve and return valve, preventing continued operation of the jet pump. The jet pump will not be damaged by operation after the tank is empty, but extended operation with an empty fuel tank may draw unnecessary moist air into the main fuel system from the empty, vented auxiliary fuel tanks.

The auxiliary fuel system will not feed into the main fuel system if there is a failure of both boost pumps (engine-driven and electrical) or a failure of the auxiliary motive flow valve. This condition will be noted by the illumination of the NO FUEL XFR annunciator on the caution/advisory/status annunciator panel. The NO FUEL XFR annunciator will illuminate when fuel pressure is less than 6 ± 1 psi at the auxiliary pressure switch and the auxiliary float switch is not in the empty position or when fuel pressure is less than 6 ± 1 psi at the extended range fuel tank pressure switch and the extended range fuel tank float switch is not in the empty position.

2.15.4 Crossfeed

During single engine operation, it may become necessary to supply fuel to the operative engine from the fuel system on the opposite side. The simplified crossfeed system is placarded for fuel selection with a diagram on the fuel control panel. Place the standby fuel pump switches in the OFF position when crossfeeding. A lever lock switch, placarded CROSSFEED FLOW, is moved from the center OFF position to the left or to the right, depending on direction of fuel flow.

2.15.5 Firewall Fuel Shutoff Valves

The firewall fuel shutoff valve switches placarded F/W VALVE PUSH are located in the glareshield to the left and right of the warning annunciator panel. The switches contain two annunciators: ENG FIRE and CLOSED. The valves are closed by depressing the switches and opened by depressing the switches again. The CLOSED annunciator illuminates to indicate that the valve is in the closed position; extinguishes to indicate that the valve is in the open position; and flashes to indicate that the valve is not in the selected position. When either switch is actuated to the closed position, the EXTINGUISHER PUSH annunciator in the corresponding fire extinguisher switch illuminates to indicate that the fire extinguisher is armed.

2.15.6 Fuel Drains

The extended range fuel tanks are equipped with one drain valve located on the lower aft end of each fuel tank. Flapper valves inside each tank prevent the fuel from surging forward.

During each preflight, the fuel drains should be drained to check for fuel contamination. There are six drains in each wing. They are located as follows:

DRAINS

Flush Fuel Drain Gravity Line Drain Fuel Drain Strainer Drain Filter Drain Inboard Fuel Tank Drain Extended Fuel Tank Drain

LOCATION

Underside of wing forward of aileron Outboard of nacelle underside of wing Outboard of nacelle underside of wing Bottom of nacelle forward of wheel well Underside of wing by wing root Bottom of extended range tank

2.15.7 Fuel Purge System

Engine compressor discharge air $(P_3$ air) pressurizes a small purge tank. During engine shutdown, fuel manifold pressure subsides, thus allowing the engine fuel manifold poppet valve to open. The purge tank pressure forces fuel out of the engine fuel manifold lines, through the nozzles, and into the combustion chamber. As the fuel is burned, a momentary surge in (N_1) gas generator rpm should be observed. The entire operation is automatic and requires no input from the crew.

2.15.8 Fuel Gauging System

Note

While transmitting on the HF system, deviations of ER Fuel Quantity displayed may be observed throughout the usable HF frequency band (2 MHz to 30 MHz). The frequency at which the deviations are observed may vary, due to issues such as the actual fuel quantity in the ER Fuel Tanks, the tuned frequency on which the HF system is transmitting, etc. The displayed ER Fuel Quantity value will return to the correct value after the HF transmission ceases.

The airplane is equipped with a capacitance type fuel quantity indication system. A maximum indication error of 3% full scale may be encountered in the system. The system is designed for the use of Jet A, Jet A1, JP-5 and JP-8 aviation kerosene, and compensates for changes in fuel density due to temperature changes. If other fuels are used, the system will not indicate correctly. See Other Procedures in Chapter 7, Shore-Based Procedures, for instructions when using Jet B, JP-4, or aviation gasoline.

The left fuel quantity indicator on the Fuel Control Panel (Figure 2-17) indicates the amount of fuel remaining in the left-side main fuel system tanks when the FUEL QUANTITY switch is in the MAIN (center) position, and the amount of fuel remaining in the left side extended range fuel tank when the FUEL QUANTITY switch is in the ER (upper) position, and the amount of fuel remaining in the left-side auxiliary fuel tank when the FUEL QUANTITY switch is in the AUX (lower) position. The RIGHT fuel quantity indicator indicates the same information for the right-side fuel systems, depending upon the position of the FUEL QUANTITY switch. The gages are marked in pounds. The TEST (upper) position of the TEST switch provides a test function of the amber L and R FUEL QTY annunciators.

STANDBY PUMP
ON
OFF

XFR OVERRIDE
AUX
A
FUEL
1275 LB EACH MAIN
730 LB EACH AUX
750 LB EACH AUX

Figure 2-17. Fuel Control Panel

2.16 ELECTRICAL SYSTEM

The primary electrical system of the UC-12W is a 28-volt direct current (Vdc) system.

2.16.1 DC System

The power sources for the DC system include one battery and two generators. The generators are actually starter-generators which are used for engine starting and dc power generation when the engines are running. The airplane also has provisions for connecting a 28Vdc external power source to the airplane during ground operation. Power from these sources is distributed to the individual electrical loads with a multi-bus system which is shown schematically in the DC Power Distribution diagram. Each power source is electrically connected to the distribution system through relays and line contactors. The buses are interconnected with bus tie relays and individual bus relays.

A color-coded ring around each circuit breaker indicates the bus the circuit breaker is connected to. The TPL FED and BAT bus circuit breakers are color-coded Yellow; L GEN bus circuit breakers are color-coded Blue; R GEN bus circuit breakers are color-coded Green; the STBY bus circuit breakers are color-coded Red; and the CTR bus circuit breakers are color-coded White.

2.16.2 Battery

The airplane battery is a 42-ampere-hour, sealed, lead-acid battery. The battery is used for engine starting and as a final redundant power source if both generators should be inoperative. The battery is controlled by a battery bus switch and a battery switch located in the Left Subpanels (Figure 2-4) master switch arrangement. The battery bus switch is placarded BAT BUS - NORM/EMER OFF and the battery control switch is placarded BAT - OFF/ON. With both switches OFF, the battery is disconnected from all electrical loads. The battery bus switch controls a remote control circuit breaker which functions as a battery bus contactor. In the NORM position, battery power is applied to the battery bus. This is the normal position since loads such as entry lights and clocks are powered from the battery bus. When the switch is in the EMER OFF position, the battery is isolated from the battery bus.

The battery switch controls the battery relay and the battery bus tie. When the battery switch is ON, the battery relay closes to apply power to the triple fed bus and the battery bus tie closes to apply power to the center bus. In the OFF position, the battery relay and battery bus tie open to disconnect the battery from all buses except the battery bus.

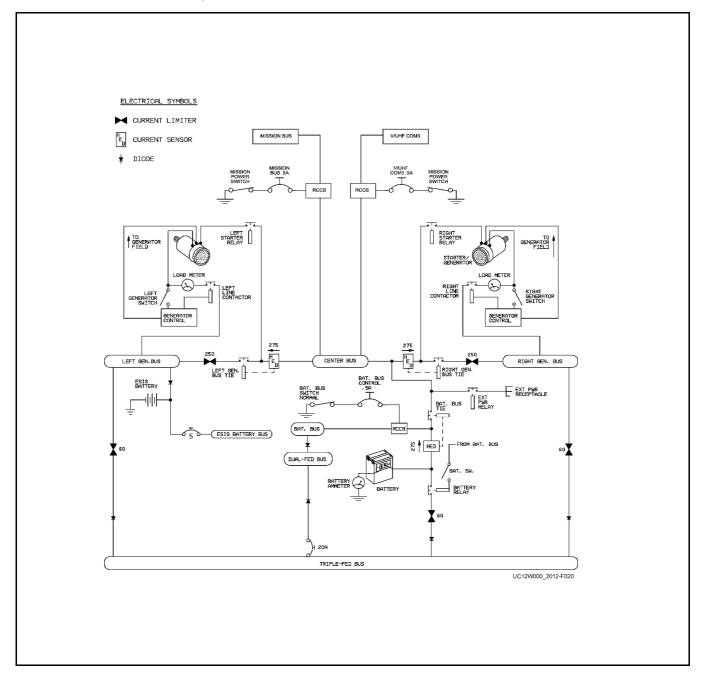
Battery current and voltage can be monitored with the battery ammeter and voltmeter located in the overhead instrument panel. To meet the battery duration times noted in the Dual Generator Emergency procedure, the battery

charge current must be 10 amps or less prior to takeoff. Takeoff with a battery charge current above 10 amps is permitted at the discretion of the pilot.

2.16.3 DC Electrical Load Distribution Schematic

Refer to Figure 2-18 for the DC Electrical Load Distribution Schematic.

Figure 2-18. DC Electrical Load Distribution Schematic



2.16.4 Avionics/Electrical Equipment Bus Connection

LEFT GENERATOR BUS			
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL		
AVIONICS BUS, L GEN	FURNISHINGS		
LH CB PNL, L GEN	CIGAR LIGHTER		
	MASTER CONTROL		
AVIONICS	INVERTER (CABIN OUTLETS)		
PILOT PFD HEATER	L BAR (REFRESHMENT)		
ELECTRICAL	LIGHTS		
BUS TIE POWER	FGP		
	LEFT LANDING		
ENGINE	MFD & RTU		
DBU	NAV		
LEFT CHIP DETR	NO SMK, FSB, & BAGGAGE		
	PILOT CNTL INSTR		
ENGINE INDICATION	PILOT PFD & DCP		
EDC1	PLT FLT SIDE PNL		
DCU1	TAIL FLOOD		
ENVIRONMENTAL	WEATHER		
BLEED AIR CONT, R	AUTO PROP DEICE		
FWD CABIN BLOWER	L FUEL VENT HEAT		
	LEFT STBY ENG ANTI-ICE		
ESIS	PILOT WSHLD ANTI-ICE CONT		
BAT CHG	PILOT WSHLD ANTI-ICE POWER		
FLIGHT			
FLAP IND & CONTROL			
FLAP MOTOR			

STANDBY BUS		
SYSTEM/CIRCUIT BREAKER LABEL SYSTEM/CIRCUIT BREAKER LABEL		
BAT	DISP	
BAT CNTL	PNL LIGHTS	
BUS CNTL	HDG SNSR	

CENTER BUS		
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL	
SUBPANEL	LANDING GEAR	
BAT POWER	LANDING GEAR MOTOR	
AVIONICS	LIGHTS	
MISSION BUS	FLASHING BEACON	
V/UHF COM 3	ICE	
	TAXI	
ELECTRICAL		
BUS TIE CONTROL	WEATHER	
BUS TIE INDICATOR	MAN PROP DEICE, L & R	
BUS TIE POWER		
TEST JACK		
ENVIRONMENTAL		
CONDENSER BLOWER		
FWD ELEC HEAT		
AFT ELEC HEAT		

RIGHT GENERATOR BUS		
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL	
AVIONICS BUS, R GEN	ENVIRONMENTAL	
LH CB PNL, R GEN	AIR COND CLUTCH	
	BLOWER, CABIN AFT	
AVIONICS	BLOWER, COCKPIT	
ADC2		
AHC2	FLIGHT	
ATC2	PITCH TRIM	
CDU2		
COM2	FURNISHING	
COPILOT AUDIO	TOILET	
COPILOT AUDIO CONT		
COPILOT DCP	LIGHTS	
COPILOT PFD	CDU1/CDU2	
COPILOT PFD HEATER	COPILOT FLT INSTR	
ELT	COPILOT INSTR CNTL	
IEC	COPILOT PFD & DCP	

RIGHT GENERATOR BUS		
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL	
GPS2	LANDING, R	
MFD HEATER	PEDESTAL CNTL	
NAV2	READING	
RADIO ALTM	RECOGNITION	
TAWS	STROBE	
3RD CREW AUDIO	SUB PNL, OVHD, & CONSOLE	
ELECTRICAL	WEATHER	
BUS TIE POWER	BRAKE DEICE	
	RIGHT FUEL VENT	
ENGINES	RIGHT STBY ENG ANTI-ICE	
RIGHT CHIP DETECTOR	RIGHT WSHLD ANTI-ICE	
PROP GOV TEST	RIGHT PITOT HEAT	
PROP SYNC	STALL WARN HEAT	
	WINDOW DEFOG	
ENGINE INDICATION		
DCU2		
EDC2		

BATTERY BUS		
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL	
AVIONICS	BUS TIE CONT	
BAT RELAY	GND COM	
BAT BUS CONT	GND HEAT	
BUS TIE IND		
VOLTMETER		

DUAL-FED BUS		
System/Circuit Breaker Label System/Circuit Breaker Label		
ENGINES	LIGHTS	
ENG FIRE EXT, L	CABIN ENTRY	
ENG FIRE EXT, R	DIGITAL CLOCK	
	DOOR LOCK	
	EMERGENCY	

TRIPLE-FED BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
AVIONICS BUS	ENVIRONMENTAL
AVIONICS	BLEED AIR CONTROL, L
ADC1	CABIN ALT HIGH
AHC1	CABIN DIFF HIGH
AHC1 SEC	ADAS
AHC2 SEC	TEMP CONTROL
ATC1	PRESS CONTROL
AURAL WARN	
AVIONICS MASTER	FLIGHT
CABIN AUDIO	OUTSIDE AIR TEMP
CCP	
COM1	FUEL SYSTEM
CVDR	FIRE WALL VALVE, L AND R
DC CONVERTER 1 (PFD1/AHC1 SEC)	STANDBY PUMP, L AND R
DC CONVERTER 2 (MFD/AHC2 SEC)	AUX FUEL XFER, L AND R
FGC2 SERVO	QTY IND, L AND R
LEFT IAPS	PRESS WARN, L AND R
MFD	QTY WARN, L AND R
MFD	CROSSFEED
NAV 1	
OXY CONTROL	LANDING GEAR
PILOT AUDIO	LDG GEAR CONT
PILOT AUDIO CONT	
PILOT DCP	LIGHTS
PILOT PFD	CABIN LIGHTS
RIGHT IAPS	INSTR INDIRECT
RTU	
START CONTROL, L AND R	WARNING/ANNUNCIATORS
VOICE RCDR	ANN IND
	ANN POWER
ELECTRICAL	AVIONICS ANNUNCIATOR
BUS TIE IND	BLEED AIR WARNING, L AND R
BUS CONTROL	LANDING GEAR IND
BUS TIE POWER	LANDING GEAR WARN
GEN RESET	OIL PRESS WARN, L AND R
	STALL WARN

TRIPLE-FED BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
ENGINE INDICATION	
AUTOFEATHER	WEATHER
DCU1 SEC	MAIN ENG ANTI-ICE, L AND R
DCU2 SEC	PROP DEICE CONTROL
FIRE DETECT, L AND R	PITOT HEAT, L
IGNITOR POWER, L AND R	SURFACE DEICE
OIL PRESS, L AND R	WSHLD WIPER
START CONTROL, L AND R	PRESS WARN, L AND R
TORQUE METER, L AND R	QTY IND, L AND R
FGC1 SERVO	

V/UHF COM 3 BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
RT	ANT CVTR
AMP	ANT RELAY
CONT	

MISSION BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
NO. 3 GPS	IFF XPNDR
FLARE CONT	WARN
FLARE PWR	TACAN
FAN PWR	

LEFT GENERATOR AVIONICS BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
AVIONICS	AVIONICS (CONT'D)
CDU1	HF COM
DME1	RADAR
FSU	TCAS
FSU FAN	
GPS1	ENVIRONMENTAL
HF ANT	NOSE EQMT COOLING

RIGHT GENERATOR AVIONICS BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
AVIONICS	AVIONICS (CONT'D)
ADC2	ELT
AHC2	GPS2
ATC2	MFD HEATER
CDU2	NAV2
COM2	RADIO ALTM
COM3	STORMSCOPE
COPILOT AUDIO	TAWS
COPILOT AUDIO CONT	
COPILOT DCP	ENVIRONMENTAL
COPILOT PFD	FLT INSTR PNL COOLING
COPILOT PFD HEATER	IEC
3RD CREW AUDIO	

TRIPLE-FED AVIONICS BUS	
SYSTEM/CIRCUIT BREAKER LABEL	SYSTEM/CIRCUIT BREAKER LABEL
AVIONICS	AVIONICS (CONT'D)
ADC1	DC CONV 1 (PFD1/AHC1-SEC)
AHC1	NAV1
ATC1	PILOT DCP
COM1	PILOT PFD

2.16.5 Generators

The engine generators are rated at 300 amps. Individual control switches are provided in the Left Subpanels (Figure 2-4). The control switch for the left generator is placarded L GEN - OFF/ON/GEN RESET. The control switch for the right generator is placarded R GEN - OFF/ON/GEN RESET. The generators are self-excited and do not require battery power for operation. To bring the generators on line, the generator switch should be momentarily placed in the GEN RESET position, then released to ON. In the GEN RESET position, the generator voltage builds up to 28V and the line contactor is open. When the generator switch is released to ON, the line contactor is allowed to close.

The generators are controlled by generator control units which provide voltage regulation, differential voltage, reverse current protection, paralleling, cross start current limiting, and over voltage protection. The voltage regulation circuit controls the generator to maintain a constant 28V output. The differential voltage circuit senses the generator output and the center bus voltage, then controls the line contactor. When the generator voltage is within acceptable limits on the center bus voltage, the line contactor will close.

Reverse current protection circuitry opens the line contactor and disconnects the generator if a reverse current condition occurs. If the condition corrects itself, the line contactor will re-close automatically.

The paralleling circuit provides load equalization between the generators. The cross start current limiting circuit limits the generator output during engine cross start operation.

The over voltage protection circuit senses the generator output voltage and de-excites the generator and opens the line contactor if an over voltage occurs. If the generator is disconnected for over voltage, it will be necessary to select GEN RESET, then ON to reset the generator.

Illumination of the amber L or R DC GEN annunciator indicates that the line contactor is open and the generator is off line. Loadmeters in the Overhead Meter Panel (Figure 2-19) indicate the load applied to each generator as a percent of generator rating.

2.16.6 External Power

The external power receptacle located under the right wing outboard of the nacelle is provided to facilitate connecting a 28 Vdc external power unit to the airplane electrical system. A control switch, placarded EXT PWR - ON/OFF - RESET is located in the Left Subpanels (Figure 2-4) and controls the external power relay. The external power relay will close when the switch is in the ON position. It is recommended that the battery be on line whenever the external power is in use. Before selecting EXT PWR - ON, the airplane voltmeter in the Overhead Meter Panel (Figure 2-19) should be used to verify that the external power voltage is within acceptable limits (28.0 – 28.4 volts).

Reverse polarity protection and over voltage protection are provided. The reverse polarity protection circuit prevents the external power relay from closing if the external power polarity is different than the airplane electrical system. The over voltage protection circuit opens the external power relay to electrically disconnect the external power from the airplane if an over voltage occurs. After an over voltage disconnection occurs, it is necessary to turn off the external power control switch to reset the over voltage circuit.

When a ground power unit is plugged into the aircraft's external power receptacle, the amber EXT PWR annunciator illuminates.

2.16.7 Bus Ties

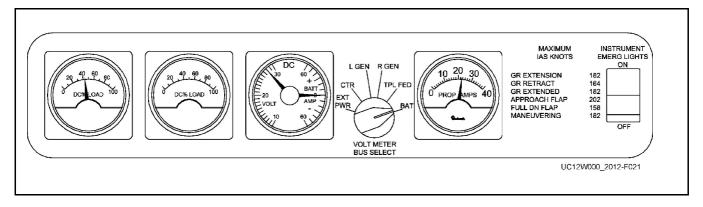
The generator buses are connected to the center bus with the left and right bus tie relays. A three-position generator bus tie control switch is located in the Left Subpanels (Figure 2-4). It is placarded GEN TIES - MAN CLOSE/NORM/OPEN. The OPEN position causes both the left and right bus tie relays to open and isolate the generator buses from the center bus. The NORM position allows the automatic closure of the left and right bus tie relays when either generator, or the external power comes on line. If the battery is the only source on line, both generator bus ties open to isolate the left and right generator bus loads from the battery. Equipment which remains operational during battery only operation is identified with a white ring around the control switch. Momentarily selecting the MAN CLOSE position during battery operation closes both generator bus ties to power the generator buses from the battery. However, this will severely limit the battery duration.

The battery bus tie connects the battery to the center bus. This bus tie is controlled by the battery switch. The battery bus tie closes when the battery switch is in the ON position, making the battery available for center bus loads or for recharging.

Bus current sensors are installed which sense current to each generator bus from the center bus and current to the center bus from the battery. If either generator bus sensor senses a high current condition, it opens the corresponding bus tie to isolate the bus. If the battery bus sensor senses a high battery discharge current, it opens the battery bus tie to isolate the battery. The battery bus sensor is defeated during engine starts and landing gear operation. The bus current sensors are controlled with the three position bus sense control switch placarded BUS SENSE - RESET/NORM/TEST. Momentarily selecting the TEST position tests the bus current sensors which cause the generator bus ties and battery tie to open. Momentarily selecting the RESET position resets the bus current sensors if they have been tripped either as a result of test or an actual high current condition.

The amber L GEN TIE OPEN, R GEN TIE OPEN, and BAT TIE OPEN annunciators are provided to indicate the positions of the bus ties. Illumination of these annunciators indicate that the corresponding bus tie is open. The green MAN TIES CLOSE annunciator indicates that the generator bus ties have been manually closed during battery operation and generator bus loads are applied to the battery.

Figure 2-19. Overhead Meter Panel



2.16.8 V/UHF COM 3 Bus

There is one V/UHF COM 3 Bus that is electrically connected to the main distribution system (Center Bus), through a V/UHF COM 3 Remote Control Circuit Breaker (RCCB). The V/UHF COM 3 RCCB is controlled by the Mission Power Switch (Figure 2-20), located in the left side of the pedestal and a 1/2-ampere circuit breaker located on the Right Circuit Breaker Panel (Figure 2-22), labeled V/UHF COM 3.

The V/UHF COM 3 RCCB electrical contacts are normally open and apply power to the V/UHF COM 3 Bus when its electrical contacts are closed. Selecting MSN PWR - ON, applies electrical power to the V/UHF COM 3 circuit breaker. Electrical power is then routed to the V/UHF COM 3 RCCB, allowing its electrical contacts to close and apply power to the V/UHF COM 3 Bus. Selecting MSN PWR - OFF, removes electrical power from the V/UHF COM 3 circuit breaker and the electrical contacts of the V/UHF COM 3 RCCB return to their normally open position. Electrical power is then removed from the V/UHF COM 3 Bus.

2.16.9 Mission Bus

There is one Mission Bus that is electrically connected to the main distribution system (Center Bus), through a Mission Bus Remote Control Circuit Breaker (RCCB). The Mission Bus RCCB is controlled by the Mission Power Switch (Figure 2-20), located in the left side of the pedestal and a 1/2-ampere circuit breaker located on the Right Circuit Breaker Panel (Figure 2-22), labeled MISSION BUS.

The Mission Bus RCCB electrical contacts are normally open and apply power to the Mission Bus when its electrical contacts are closed. Selecting MSN PWR - ON, applies electrical power to the MISSION BUS circuit breaker. Electrical power is then routed to the Mission Bus RCCB, allowing its electrical contacts to close and apply power to the Mission Bus. Selecting MSN PWR - OFF, removes electrical power from the MISSION BUS circuit breaker and the electrical contacts of the Mission Bus RCCB return to their normally open position. Electrical power is then removed from the Mission Bus.

2.16.10 Avionics Relays

There are three avionics buses which are electrically connected to the main distribution system through avionics relays. The relays are controlled by a single avionics control switch located in the Left Subpanels (Figure 2-4) and placarded AVIONICS MASTER POWER - OFF.

The avionics relays are normally closed relays and apply power to the avionics buses when the relays are relaxed. Selecting AVIONICS MASTER POWER - ON opens the control circuit, allowing the relays to return to the normally closed positions and apply power to the avionics buses. The OFF position of the avionics control switch applies control power to the relays to disconnect the avionics buses. Power to control the avionics relays is provided from the AVIONICS MASTER circuit breaker in the Right Circuit Breaker Panel (Figure 2-22). If the avionics buses become disconnected as a result of a control circuit fault, the AVIONICS MASTER circuit breaker can be pulled to restore power.

Note

The RTU system is not installed on this aircraft and the associated RTU circuit breaker on the Right Circuit Breaker Panel (Figure 2-22) has been pulled and collared.

2.17 LIGHTING SYSTEMS

2.17.1 Cockpit

An Overhead Light Control and Meter Panel (Figure 2-24), easily accessible to both pilot and copilot, incorporates a functional arrangement of the lighting system controls. The panel also incorporates a switch placarded FSB ON-OFF which controls the seat belt attendant chimes.

2.17.2 Cabin

The cabin indirect lights are controlled by a three-position switch located in the Overhead Light Control and Meter Panel (Figure 2-24), placarded CABIN LIGHT-BRIGHT-DIM-OFF. Cabin light intensity may also be controlled by a two-section (+increase/-decrease) touch switch. The touch switch is located in the center of the cabin headliner approximately midway between the exit signs.

When the cabin indirect light control switch is placed in the DIM position from the OFF position, the cabin indirect lights illuminate in the full bright mode and the dim control is enabled. The intensity of the cabin indirect lights may be changed by momentarily touching the appropriate section of the touch switch.

Note

In the event the cabin indirect lights shut off, place the Cabin Light switch located on the overhead light control panel in the OFF position and then in the DIM or BRIGHT position.

Placing the cabin light control switch in either the BRIGHT or OFF position will override the dim switch.

The aft compartment is illuminated by two reading lights in the headliner which are illuminated by placing the aft cabin light switch to the BAGGAGE position.

A threshold light is located forward of the airstair door at floor level, and spar cover lights are located at floor level fore and aft of the spar cover. A switch adjacent to the threshold light turns these lights on and off. This switch also turns the exterior entry light on and off. When the airstair door is closed, all the lights controlled by the threshold light switch will extinguish.

When the master switch is on, passengers may turn the individual reading lights along the top of the cabin on or off with a switch in the sidewall table locations.

Two exit lights (one in the forward cabin between the emergency exits, and one in the aft cabin at the airstair door) are installed in the center of the cabin headliner. Each light is equipped with two light sources. One light source, which is illuminated during normal operations, is powered from the airplane's electrical system. The other light source is powered by internal batteries and is controlled by a three-position rocker switch (spring-loaded to the center position) placarded ON-TEST/OFF-RESET. The light illuminates when the switch is momentarily placed in the ON-TEST position. The light extinguishes when the switch is momentarily placed in the OFF-RESET position. An internal "g" switch automatically activates the light if rapid deceleration is sensed.

2.17.3 Exterior

Switches for the landing lights, taxi light, wing ice lights, navigation lights, recognition lights, beacons, strobe lights, and tail flood lights are located on the Left Subpanels (Figure 2-4).

Figure 2-20. Mission Power Switch

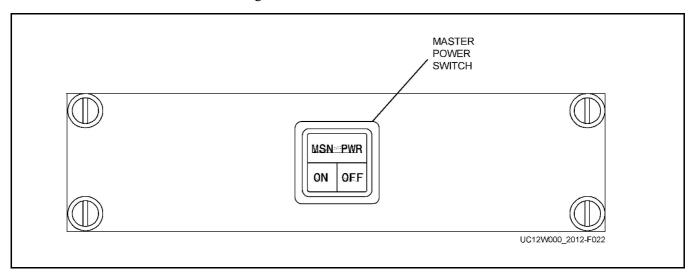
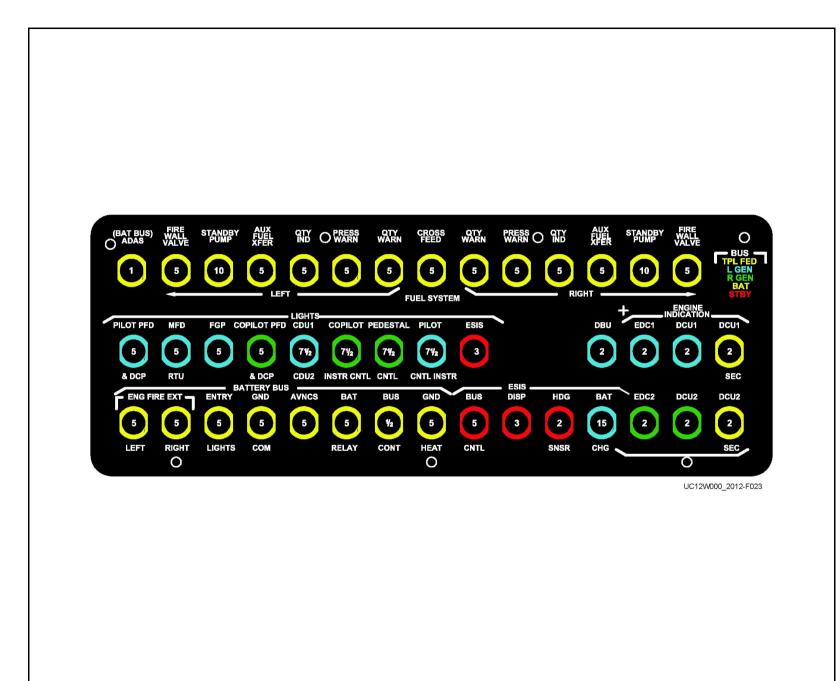


Figure 2-21. Left Circuit Breaker Panel



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Figure 2-22. Right Circuit Breaker Panel

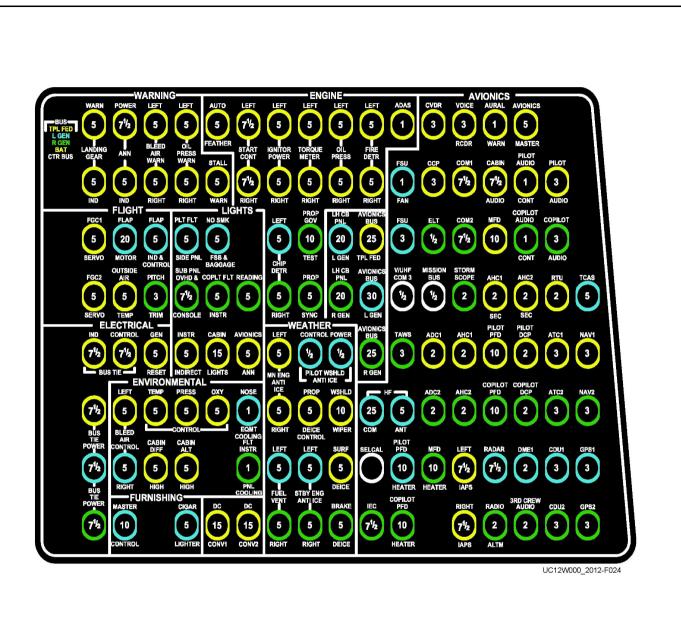


Figure 2-23. Auxiliary Circuit Breaker Panel

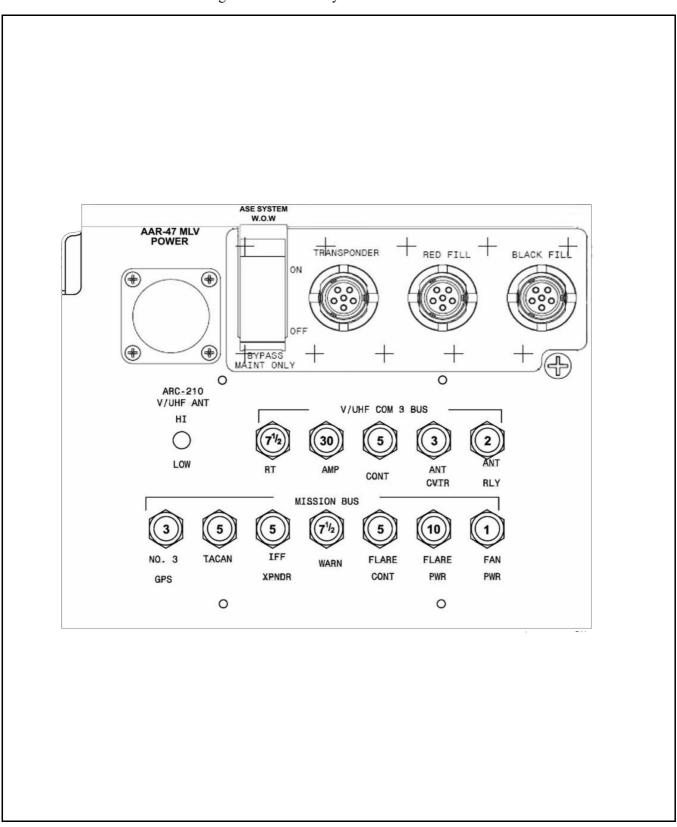
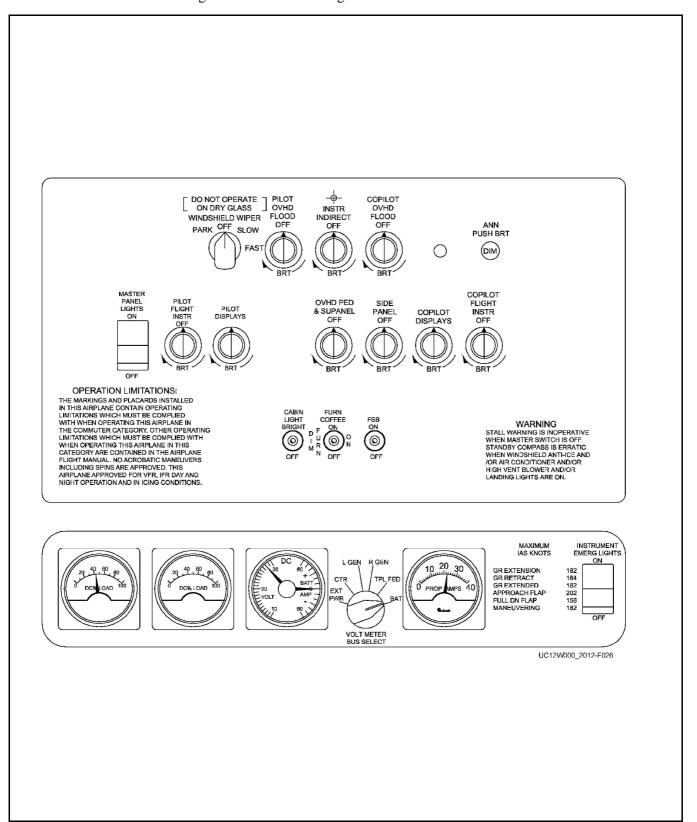


Figure 2-24. Overhead Light Control and Meter Panel



2.18 ENVIRONMENTAL SYSTEM

2.18.1 Pressurization System

The cabin pressurization system consists of two separate systems: the pressurization air inflow system and the cabin pressure control system. The pressurization system is designed to provide a normal working pressure differential of 6.5 ± 0.1 psi, which will provide cabin pressure altitudes of approximately 2,800 feet at an airplane altitude of 20,000 feet; 8,600 feet at 31,000 feet; and 10,380 feet at 35,000 feet. Refer to Figure 2-25.

2.18.1.1 In-Flow System

The pressurization air in-flow system consists of a bleed air flow control valve for each engine that is controlled by 2 three-position switches placarded BLEED AIR VALVES - LEFT - RIGHT in the Environmental group on the Right Subpanels (Figure 2-5). The three switch positions are placarded OPEN - ENVIR OFF - PNEU & ENVIR OFF. When a switch is in either the ENVIR OFF or the PNEU & ENVIR OFF position, the respective right or left environmental air valve is closed and the amber L BL AIR OFF and R BL AIR OFF annunciators will illuminate. When a switch is in the OPEN position, the air mixture will flow through the valve toward the cabin.

Environmental bleed air flow volume is controlled by the switch placarded ENVIR BLEED AIR - NORMAL-AUTO-LOW in the Environmental group on the Right Subpanels (Figure 2-5). The LOW position reduces the bleed air extracted from the engines for environmental purposes to approximately half the normal amount. This position may be used during operations in ambient temperatures above 10 °C to ensure takeoff power is available. The NORMAL position may be used for increased heating or if increased pressurization airflow is required. This position should be selected during the climb phase of flight to ensure optimum performance of the pressurization system at higher altitudes. The AUTO position is the recommended setting, and it allows the environmental system controller to automatically select the flow setting based upon the heat demanded to maintain cabin/cockpit temperature or cabin pressure requirements. The default flow setting will be LOW in all environmental cases except when the system is demanding additional heat. In order for the Bleed Air AUTO position to function properly in response to the heating/cooling requirements as commanded by the controller, the Environmental Mode exchanger bypass valves to prevent any duct over temperatures. If the environmental control knob is selected to MAN HEAT, the bleed flow defaults to NORMAL. If the flow is selected to MAN COOL, the bleed flow defaults to LOW. Control must be selected to the AUTO position. If the CABIN ALTITUDE annunciator.



Always monitor cabin pressurization requirements if in MAN COOL. Manual adjustments to the ENVIR BLEED AIR flow setting may be required.

For maximum engine performance and/or high altitude take-off requirements, the ENVIR BLEED AIR switch should be manually selected to LOW.

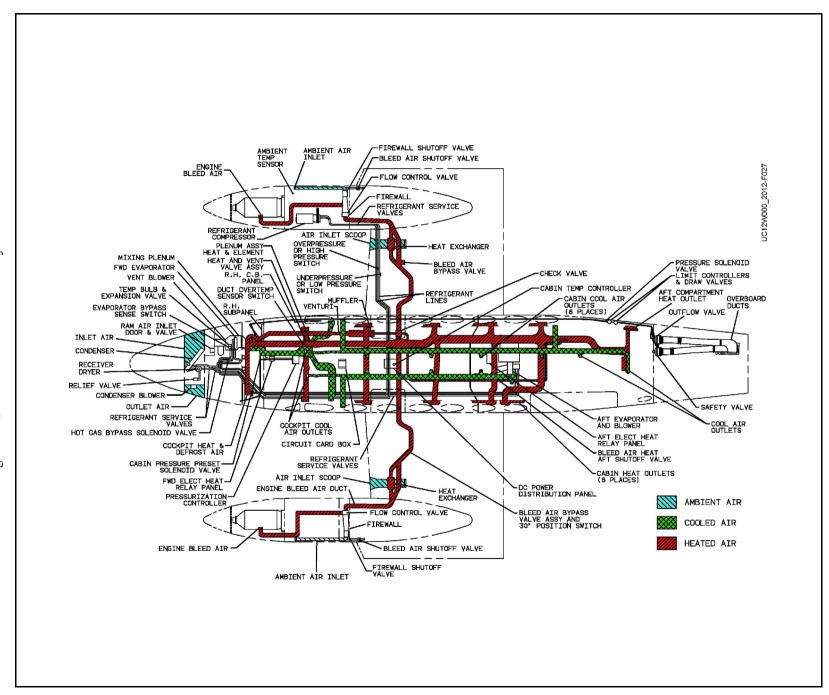
2.18.2 Cabin Pressure Control System

The cabin pressure control system consists of an outflow valve and a safety valve, which are vented overboard to preclude moisture build-up in the aft fuselage, and a pressurization controller. Refer to Figure 2-25.

The pressurization controller, mounted in the pedestal, controls modulation of the outflow valve. The outer scale (CABIN ALT) of the dual-scale indicator dial indicates the cabin pressure altitude which the controller is set to maintain. The inner scale (ACFT ALT) indicates the maximum ambient pressure altitude at which the airplane can fly without causing the cabin pressure altitude to exceed the value selected on the outer scale (CABIN ALT) of the dial.

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Figure 2-25. Environmental Control System



The rate control selector knob is placarded RATE - MIN - MAX. The rate at which the cabin pressure altitude changes is controlled by rotating the rate control selector knob. The rate of change selected may be from a minimum of approximately 200 to a maximum of approximately 2,000 feet per minute.

The actual cabin pressure altitude is continuously indicated by the cabin altimeter, which is mounted in the right side of the panel that is co-located with the caution/advisory/status annunciator panel. Immediately to the left of the cabin altimeter is the cabin vertical speed (CABIN CLIMB) indicator, which continuously indicates the rate at which the cabin pressure altitude is changing.

The cabin pressure switch, located on the pedestal, is placarded CABIN PRESS - DUMP - PRESS - TEST. When this switch is in the DUMP (forward) position, the cabin will depressurize up to approximately 13,500 feet. Above that altitude, it will maintain approximately 13,500 feet. When it is in the PRESS (center) position, the cabin may be pressurized in flight, depending on the controller setting. The TEST (aft) position allows the pressurization control system operation to be verified on the ground before takeoff.

Prior to takeoff, the cabin altitude selector knob should be adjusted so that the ACFT ALT scale on the indicator dial indicates an altitude approximately 1,000 feet above the planned cruise pressure altitude, or the CABIN ALT scale indicates an altitude at least 500 feet above the take-off field pressure altitude. The rate control selector knob should be adjusted as desired; setting the index mark at the 12-o'clock position will provide the most comfortable cabin rate of climb. The cabin pressure switch should be checked to ensure that it is in the PRESS position. As the airplane climbs, the cabin pressure altitude climbs at the selected rate of change until the cabin reaches the selected pressure altitude. The system then maintains cabin pressure altitude at the selected value. If the airplane climbs to an altitude higher than the value indexed on the ACFT ALT scale of the dial on the face of the controller, the cabin-to-ambient pressure differential will reach the pressure relief setting of the outflow valve and safety valve (6.5 psi cabin-to-ambient differential). The red CABIN DIFF HI warning annunciator will illuminate at 6.9 ±.3 psi cabin-to-ambient differential pressure. Refer to the Differential Pressure (CABIN DIFF HI annunciator) procedure in Chapter 13, Emergency Procedures, for corrective action.

The white CABIN ALTITUDE annunciator will illuminate and an aural warning tone will sound if the cabin pressure altitude should reach a value of 10,000 feet. The aural warning tone may be cancelled by depressing the CABIN ALT WARN SILENCE button located on the Right Subpanels (Figure 2-5). If the cabin pressure altitude should reach a value of 12,000 feet, the red CABIN ALT HI annunciator will illuminate, the MASTER WARNING flashers will illuminate, and the aural warning tone will sound. The aural warning tone may again be cancelled as before, but the white CABIN ALTITUDE and red CABIN ALT HI annunciators will remain illuminated as long as the cabin pressure altitude remains above their respective actuation altitudes. At 12,500 feet, the oxygen masks will drop out. During cruise operation, if the flight plan calls for an altitude change of 1,000 feet or more, reselect the new altitude plus 1,000 feet on the CABIN ALT dial. During descent and in preparation for landing, the cabin altitude selector should be set to indicate a cabin altitude of approximately 500 feet above the landing field pressure altitude.

2.18.3 Ventilation

Fresh air ventilation is provided from the pressurization inflow system, which is available during both the pressurized and the unpressurized mode. Refer to Figure 2-25.

2.18.4 Heating Systems

2.18.4.1 Bleed Air Heating

Engine bleed air, through the Bleed Air Valves, is utilized to warm the cockpit and cabin. Heating air outlets are provided for each pilot under the instrument panel, and in the floor, outboard of the pilots seats. The COCKPIT TEMP control knob, located in the Environmental group on the Right Subpanels (Figure 2-5), regulates the temperature of the air supplied to these outlets while in the AUTO mode. A constant flow of conditioned air is supplied to the glareshield outlets and the windshield defrost outlets. In AUTO mode, this temperature is regulated to a maximum default temperature of approximately 70 °F. In colder applications when more heat is initially demanded, this outlet duct temperature is allowed to reach approximately 105 °F. In MAN HEAT, the overhead and glareshield duct temperatures are fully controllable by the COCKPIT/CABIN TEMP knobs, which regulate the amount of heat added to the recirculated air exiting these outlets. If the bleed air temperature in the ducts supplying

the floor outlets becomes excessive, the amber DUCT OVERTEMP annunciator will illuminate. Refer to the Duct Overtemperature procedure in Chapter 13, Abnormal Procedures, for corrective action.

2.18.4.2 Electric Heating

A supplemental electric heating system is available for cabin conditioning. It is operated by rotating the MODE knob in the Environmental group on the Right Subpanels (Figure 2-5), to the ELEC HEAT position. The supplemental electric heating system can only be used on the ground.



Do not operate the electric heat with the pedestal floor outlet blocked. Damage may result to the electric heater elements.

This system utilizes a heater assembly containing six heating elements located in a duct aft of the forward evaporator. The cockpit blower is used to distribute air through the electric heating duct, and will operate automatically when the ELEC HEAT mode is selected. Heated air is directed into the cabin through a single floor outlet located directly aft of the cockpit pedestal. The blower will operate at maximum speed regardless of the indication of the COCKPIT BLOWER knob. An amber ELEC HEAT ON caution annunciator is provided to indicate that the electric heat power relay is closed and applying power to the electric heat power control relay for the heating elements. When the ELEC HEAT mode is deselected the ELEC HEAT ON annunciator must extinguish to verify that power is removed from the heating elements. If it remains illuminated, the system is not operating properly and maintenance is required prior to flight. In order to maintain airflow across heating elements, ELEC HEAT should be re-selected until airplane is shutdown. Safety devices built into the heater assembly may continue to temporarily power the blower at a low speed to cool the heater elements and avoid overheating the duct. In the event that residual heat in the elements causes the duct temperature to rise after the blower has initially shutdown, the blower will automatically cycle to cool the elements regardless of Battery switch position. When the airplane is not powered, this blower is powered through the GND HEAT circuit breaker located in the Left Circuit Breaker Panel (Figure 2-21).

Note

The electric heat system will draw approximately 160 amps.

2.18.4.3 Radiant Heating

A radiant heater element is installed in the cargo door. It is controlled by the MODE selector switch and operates in all heating modes. This unit provides supplemental heat to the cabin for additional passenger comfort.

2.18.5 Cooling Systems

Cabin/Cockpit air conditioning is provided by a vapor-cycle refrigeration system. The compressor, driven by the right engine, will operate as required in the AUTO or MAN COOL control modes, provided operation is not prohibited by the system protection controls. System protection controls will prevent compressor operation if refrigerant pressure is too high or too low, if the bleed air bypass valve has reached a limit switch (indicating significant heat is being introduced), or if right engine is below 62% N_1 . If operation is prevented due to low N_1 speed, the white AIR COND N_1 LOW annunciator will illuminate.

The cockpit blower assembly recirculates cockpit air through the forward evaporator and into the four cockpit distribution ducts which supply glareshield outlets and windshield defrost. Two cabin blower assemblies provide cooling to the main cabin by recirculating cabin air through two evaporators and into ducting which supplies the nine eyeball air outlets in the cabin headliner, and the two eyeball air outlets in the cockpit headliner.

2.18.5.1 Environmental Controls

The Environmental control section on the Right Subpanels (Figure 2-5) provides for automatic or manual control of the system. The system is a dual zone design, allowing for independent control to the temperature in the cabin and cockpit.

2.18.5.1.1 Automatic Mode Control

When the MODE selector switch is set to the AUTO position, the heating and air conditioning systems operate automatically. The system will automatically adjust blowers speed, bleed air temperature and compressor clutch on/off state to maintain the temperature setpoints selected via the TEMP knobs. The recommended temperature setting is straight up at the 12 o'clock position which equates to approximately 75 °F. In addition, the controller will modulate 4 servo-operated airflow valves in the bleed air heat ducting that direct bleed air into the various sections of the airplane on an "on demand" basis in order to help maintain the desired temperature setpoints. When there is little or no demand for bleed air heat in the cabin or cockpit, the majority of the conditioned bleed air is directed aft to the baggage compartment. Temperature sensing devices in the cockpit and cabin, in conjunction with the TEMP settings, signal the controller to make the necessary adjustments to maintain the setpoint temperature. If at any time the operator wishes to manually select a different blower speed, the BLOWER control can be rotated out of the AUTO detent to the desired speed. User patience should be practiced with the temperature control setpoint. The controller will maintain setpoint over time. This slow transition is purposefully built-in to eliminate unwanted temperature variations.

2.18.5.1.2 Manual Mode Control

When the MODE selector switch is set to the MAN HEAT position, the Cockpit and Cabin floor heat servos are fully opened and regulation of the cabin and cockpit temperatures is accomplished by actuating the MAN TEMP switch to either the INCR or DECR position as desired. This regulates the temperature of the bleed air entering the airplane, while the flow rate remains unchanged. Bleed air temperature response is proportional to the length of time the MAN TEMP switch is actuated with approximately 30 seconds required to go from full increase to full decrease or vice versa. Actuations should be 2 - 3 seconds in duration with approximately 60 seconds in between to avoid temperature over/undershoot.



Longer than 2 - 3 second switch actuations and shorter than 60 seconds in between may result in a duct overheat situation. Refer to the Duct Overtemperature procedure in Chapter 13, Abnormal Procedures, if this occurs.

The COCKPIT TEMP control knob can then be used to manually select the temperature of the glareshield and windshield defrost outlets. The CABIN TEMP control works similarly. When the TEMP control is rotated to full counter clockwise (CCW), the air out of the cabin and cockpit overhead outlets is the coolest (recirculated air without added bleed air heat). The CABIN and COCKPIT BLOWER controls can be used in this mode to control the amount of recirculated air coming out of the appropriate outlets for air circulation.

When the MODE selector switch is set to the MAN COOL position, the air conditioner system will operate, provided the speed of the right engine is above 62% N₁, and the system pressures are within range. To prevent the evaporator coils from freezing, the blowers will default to a preset minimum speed. In this mode, the TEMP setting knobs operate the same as in MAN HEAT and blower speed can be changed by varying the CABIN and COCKPIT BLOWER controls.



In either manual modes, it is the responsibility of the pilot to actively monitor the temperature and flow of the bleed air entering the cabin to prevent the evaporator coils from freezing.

2.18.5.2 Electric Heat Mode Control

When the MODE selector switch is set to the ELEC HEAT position, air is directed over resistive heater elements and into the cabin as described above under the ELECTRIC HEATING section. This mode is only operative on the ground.

2.18.5.3 Using Blowers For Air Recirculation

COCKPIT and CABIN BLOWER speed may be manually adjusted to obtain the desired amount of flow exiting the outlets for air recirculation in any mode except ELEC HEAT, where the cockpit blower defaults to a high setting.

When the blower switches are in the AUTO detent (full CCW), and the Environmental Mode control is in AUTO, blower speed will be adjusted automatically by the controller. When predominantly cooling the cockpit/cabin, the further the actual cockpit/cabin temperature is away from the selected setpoint, the higher the blower speed will be. As the actual temperature approaches the setpoint temperature, the controller will begin to reduce the blower speed until the setpoint temperature is achieved. At this point the blower speed will be maintained at a default minimum speed. When predominantly heating the cockpit/cabin, the blower will default to a minimum speed.

2.18.5.4 Fault Diagnosis

If the environmental controller detects an open or erratic reading on one or more of the temperatures sensors throughout the airplane and the Environmental Control knob and COCKPIT BLOWER are selected to AUTO, the cockpit blower will pulse between high and low setting within a time period of approximately 5 seconds. If this occurs, it is recommended not to operate the environmental control system in AUTO until the problem is rectified. The blowers can be operated out of LOW speed as desired/required if this fault is detected.

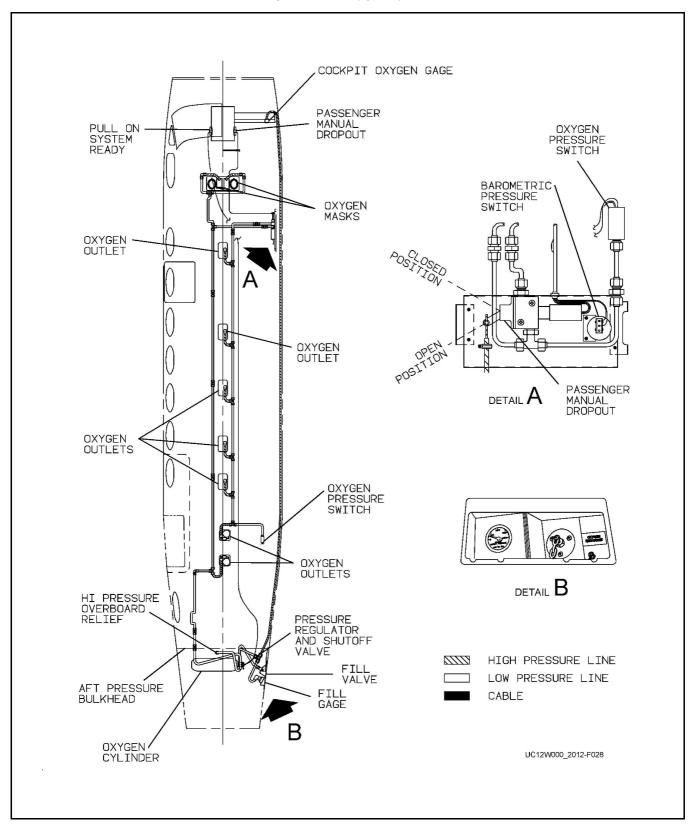
2.19 WINDOW DEFOG SYSTEM

The window defog system is designed to prevent fog or frost from blocking vision through the cockpit side "D" windows and the cabin windows. The system consists of bleed air tubes which direct flow onto the windows, plus an anti-fog coating applied to the inside surface of both cockpit side "D" windows. When the airplane is in flight and the WINDOW DEFOG switch on the Right Subpanels (Figure 2-5) is in the ON position, warm engine bleed air flows to the windows. The WINDOW DEFOG switch should be selected ON well before descent into warm, moist air, or any other time there is fog or frost on the windows. The defog system is deactivated whenever the airplane is on the ground.

2.20 OXYGEN SYSTEM

The Oxygen System (Figure 2-26) provides adequate oxygen flow for crew and passengers for a cabin pressure altitude of up to 35,000 feet. The oxygen duration chart (Chapter 7, Shore-Based Procedures) is based on a flow rate of 3.9 LPM-NTPD per mask. Each diluter demand crew mask should be counted as two masks at 3.9 LPM-NTPD if it is being used in the 100% or EMERG mode. Before each flight, check the oxygen supply pressure gage on the Right Subpanels (Figure 2-5) and verify that sufficient oxygen is available for the flight.

Figure 2-26. Oxygen System



A push/pull handle (PULL ON SYSTEM READY) located on the left side of the pedestal arms the oxygen system and should be pulled out prior to every flight to ensure that oxygen will be immediately available anytime it is needed. When the handle is pulled out, the primary oxygen supply line is charged and oxygen is supplied to the two crew outlets in the cockpit, to the first aid outlet in the toilet area, and to the passenger oxygen system shutoff valve. An amber OXY NOT ARMED annunciator, located on the caution/advisory/status panel, will be illuminated whenever (1) the oxygen arming handle has not been pulled out, or (2) pulling the oxygen arming handle failed to charge the system.

The crew is provided with diluter-demand, quick-donning oxygen masks which are located in the overhead. The crew masks should always be plugged in and stowed so that oxygen will be immediately available when required. This will not cause a loss of oxygen since the diluter demand masks deliver oxygen only upon inhalation. To don the mask, grasp the red levers protruding from the stowage compartment and pull the mask down. Inflate the mask harness by depressing the red lever on the left side of the regulator and then don the mask and release the lever. Three modes of operation are available to the crew: NORMAL (diluted oxygen), 100% and EMERG. NORMAL or 100% can be used at any altitude at the user's discretion and is controlled by a selector lever on the bottom right side of the regulator. The EMERG mode supplies a positive pressure to the face piece and should be used if smoke or fumes are present in the cabin. To use the mask in the EMERG mode, turn the emergency knob located on the bottom of the regulator. After donning the mask, check the flow indicator in the oxygen supply hose to ensure oxygen is being supplied to the regulator (RED — no flow; WHITE — flow). The crew masks also contain integral microphones.

Anytime the primary oxygen supply line is charged, oxygen can be obtained from the first aid oxygen mask located in the toilet area by manually opening the overhead access door and opening the ON-OFF valve inside the box.

The passenger oxygen system is of the constant-flow type. Anytime the cabin pressure altitude exceeds approximately 12,500 feet, the passenger oxygen system shutoff valve will open and oxygen will flow into the passenger supply line, causing the passenger masks to automatically drop out of their containers in the overhead. The lanyard pin at the top of the oxygen mask hose must be pulled out in order for oxygen to flow from the mask. The pin is connected to the oxygen mask by a cord; when the mask is pulled down for use, the cord pulls the pin out of the lanyard valve. The lanyard pin must be reinserted into the valve in order to stop the flow of oxygen to the mask. When oxygen flows into the passenger oxygen supply line, the white PASS OXYGEN ON annunciator in the caution/advisory/status annunciator panel will illuminate and the cabin lights will automatically illuminate in the full bright mode. The passenger oxygen system can be manually activated by pulling the (PASSENGER MANUAL DROP OUT) push/pull handle located on the right side of the pedestal. Passenger oxygen can be shut off and the remaining oxygen isolated to the crew and first aid outlet by pulling the oxygen control circuit breaker in the Environmental group on the Right Circuit Breaker Panel (Figure 2-22), providing the PASSENGER MANUAL DROP OUT handle is pushed in to the OFF position.

2.21 PITOT AND STATIC SYSTEM

Independent pitot and static systems (Figure 2-27) are provided for the pilots flight indicators and the copilots flight indicators.

The pilots and copilots pitot masts are located on the nose section of the airplane. Each mast provides total air pressure to its respective air data computer (ADC). The copilots mast also provides total air pressure to the Electronic Standby Instrument System (ESIS).

Dual static air ports are located on each side of the aft fuselage in a vertical arrangement. The top port on the left side is connected to the bottom port on the right side and the resulting average pressure is supplied to the pilots static air source valve. In addition, an alternate static air source is provided to the pilots static air source valve from the aft side of the rear pressure bulkhead. The output from the pilots static air source valve is manually selected by the crew and provides either normal static air pressure or alternate static air pressure to the pilots ADC. The bottom static port on the left side of the fuselage is connected to the top static port on the right side of the fuselage and the resulting average pressure is supplied to the copilots ADC and the ESIS.

AFT **PRESSURE PITOT** STATIC BULKHEAD **ESIS** TOP RIGHT **FUSELAGE** COPILOT **₩** STATIC COPILOT INDICATORS **PORTS BOTTOM** ADC COPILOT STATIC PILOT STATIC DRAIN COPILOT'S MFD TOP LEFT PITOT **3 FUSELAGE** MAST PILOT PILOT STATIC ADC **PORTS INDICATORS** BOTTOM PILOT'S PILOT'S PITOT ALTERNATE DRAIN DRAIN STATIC STATIC AIR MAST AIR SOURCE DATA BUS SOURCE AIR TEMP VALVE UC12W000_2012-F029 **PROBE**

Figure 2-27. Pitot and Static System Schematic

In addition to pitot and static air pressure inputs, the pilots and copilots ADCs also receive separate inputs of air temperature. With these inputs, each ADC is capable of supplying digital air data to the pilots and copilots PFDs and the MFD via data buses for the display of the following information:

- 1. Uncorrected Pressure Altitude.
- 2. Baro-Corrected Altitude.
- 3. Vertical Speed.
- 4. Airspeed (KIAS & KCAS).
- 5. Indicated Airspeed Trend Vector.
- 6. Mach Number.
- 7. Maximum Airspeed (V_{MO}/M_{MO}).
- 8. True Airspeed.
- 9. Total Air Temperature (TAT).
- 10. Static Air Temperature (SAT).
- 11. ISA Delta Temperature.

The pilots static air source valve is located on the right side panel in the cockpit. The alternate static air source is selected by lifting a spring-loaded retaining clip and moving the valve handle aft from the NORMAL position to the ALTERNATE position.

WARNING

The pilots airspeed, altitude and vertical speed indications will change when the alternate static air source is activated. Refer to the Airspeed Calibration — Alternate System, and the Altimeter Correction — Alternate System graphs in A1-C12WA-NFM-200, Performance Data Supplement, for operations when the alternate static air source is selected.

When the alternate static air source is no longer needed, ensure that the static air source valve is returned to the NORMAL position.

Three petcocks are provided to drain moisture from the static air lines. They are located behind an access cover below the circuit breakers on the right side panel. The drain valves should be opened to release any trapped moisture during each phase inspection and during any other ground inspection when contamination of the static lines is suspected.

2.21.1 Speed Warning System

The Speed Warning System is a dynamic pressure-sensing device which provides an aural cockpit warning in the event the airplane exceeds V_{MO}/M_{MO} limits. The system consists of a pressure switch tied into the pilots Pitot-Static system and a cockpit aural warning with test switch. The system will provide an overspeed warning independent of the airspeed displayed on the PFD/MFD. In the event the Speed Warning sounds, reduce airspeed immediately until the warning cancels.

2.22 ENGINE BLEED AIR PNEUMATIC SYSTEM

High-pressure bleed air from each engine compressor, routed through the firewall shutoff valves and regulated at 18 psi, supplies pressure for various systems and a vacuum source. Vacuum is derived from a bleed air ejector. One engine can supply sufficient bleed air for these systems. Refer to Figure 2-28.

During single-engine operation, a check valve in the bleed air line from each engine prevents flow back through the line on the side of the inoperative engine. A vacuum gage calibrated in inches of mercury, located on the Right Subpanels (Figure 2-5), indicates vacuum. To the right of the vacuum gage is a pneumatic pressure gage, calibrated in pounds per square inch, which indicates air pressure available to the deice distributor valve.

2.22.1 Bleed Air Warning System

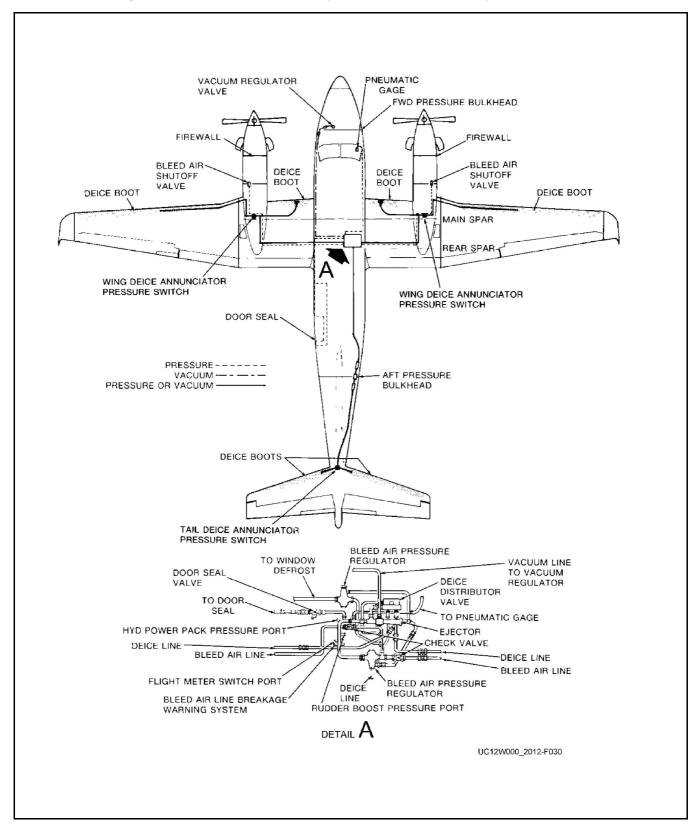
A Bleed Air Warning System is provided to warn of excessive heat caused by bleed air line rupture or leakage. A failure is indicated by the illumination of the amber L BL AIR FAIL or R BL AIR FAIL annunciator in the Warning Annunciator Panel (Figure 2-8). With the indication of bleed air line failure, the bleed air for that side should be turned off by placing the respective lever-lock BLEED AIR VALVE switch on the Right Subpanels (Figure 2-5) in the PNEU & ENVIR — OFF position. The ECS switch should be placed in MAN HEAT position and MAN TEMP switch held in DECR position for 30 seconds and then increased to maintain cabin/cockpit temperature. The bleed air warning system consists of pressurized plastic tubing that will melt when exposed to excessive heat. Therefore, the bleed fail annunciators will not extinguish when the bleed air valve is turned off.

2.23 STALL WARNING SYSTEM

Angle of attack is sensed by aerodynamic pressure on the lift transducer vane located on the left wing leading edge. When a stall is imminent, an aural stall warning activates.

The system has preflight checkout capability through the use of a switch placarded STALL WARN TEST - OFF - LDG GEAR WARN TEST on the Right Subpanels (Figure 2-5). Holding this switch in the STALL WARN TEST position activates the stall warning system.

Figure 2-28. Pneumatic Bleed Air System and Surface Deice System Schematic



2.24 ICE PROTECTION SYSTEMS

2.24.1 Windshield Heat

Two levels of heat are provided for each windshield. When the switches are in the NORMAL (up) position, heat is supplied to the major portion of the windshields. When they are in the HIGH (down) position, a higher level of heat is supplied to a smaller area of the windshields. Each switch must be lifted over a detent before it can be moved into the HIGH position. This lever-lock feature prevents inadvertent selection of the HIGH position when moving the switches from NORMAL to the OFF (center) position.



Erratic operation of the magnetic compass will occur while windshield heat is being used.

2.24.2 Propeller Electric Deice System

The Propeller Electric Deice System (Figure 2-29) includes: electrically heated deice boots, slip rings and brush block assemblies, a timer for automatic operation, ammeter, circuit breaker located on the right side panel for deice control circuit protection, and two switches located on the Left Subpanels (Figure 2-4) for automatic or manual control of the system.

A circuit breaker switch located on the Left Subpanels (Figure 2-4), placarded PROP-AUTO, is provided to activate the system timer. The timer switches every 90 seconds resulting in a complete cycle in approximately 3 minutes.

A manual prop deice system is provided as a backup to the automatic system. A control switch located on the Left Subpanels (Figure 2-4), placarded PROP - MANUAL controls the manual override relay. When the manual position is selected, power is supplied to the heating elements of both propellers simultaneously. This switch is of the momentary type and must be held in position for approximately 90 seconds. The prop deice ammeter will not indicate a load while the propeller deice system is being utilized in the manual mode. However, the loadmeters will indicate an approximate 10% increase of load per meter while the manual prop deice system is operating.

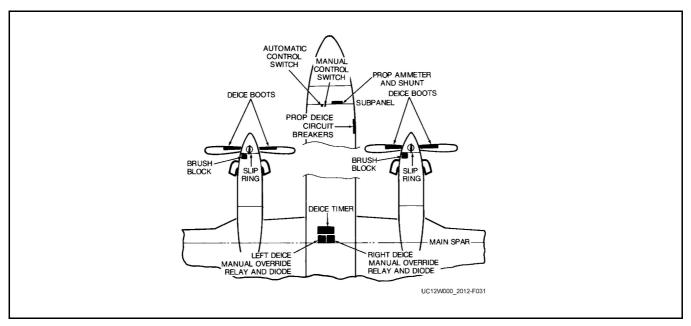


Figure 2-29. Propeller Electric Deice System

2.24.3 Pitot Mast Heat

Heating elements are installed in the pitot masts located on the nose. Each heating element is controlled by an individual circuit breaker switch placarded PITOT - LEFT - RIGHT, located on the Left Subpanels (Figure 2-4). A failure is indicated by illumination of the amber L PITOT HEAT or R PITOT HEAT annunciator, located on the caution/advisory/status panel. Illumination of these annunciators indicates that pitot mast heat is inoperative. The annunciators will also illuminate anytime the PITOT switches are in the OFF position. It is not advisable to operate the pitot heat system on the ground except for testing or for short intervals of time to remove ice or snow from the masts.

2.24.4 Surface Deice System

The surface deice system removes ice accumulations from the leading edges of the wings and horizontal stabilizers. Ice removal is accomplished by alternately inflating and deflating the deice boots. Pressure-regulated bleed air from the engines supplies pressure to inflate the boots. A venturi ejector, operated by bleed air, creates vacuum to deflate the boots and hold them down while not in use. To assure operation of the system in the event of failure of one engine, a check valve is incorporated in the bleed air line from each engine to prevent loss of pressure through the compressor of the inoperative engine. Inflation and deflation phases are controlled by a distributor valve.



Operation of the surface deice system in ambient temperatures below -40°C can cause permanent damage to the deice boots.

A three-position switch on the Left Subpanels (Figure 2-4) placarded: SURFACE DEICE - SINGLE - OFF -MANUAL, controls the deicing operation. The switch is spring-loaded to return to the OFF position from SINGLE or MANUAL. When the SINGLE position is selected, the distributor valve opens to inflate the wing boots. After an inflation period of approximately 6 seconds, an electronic timer switches the distributor to deflate the wing boots, and a 4-second inflation begins in the horizontal stabilizer boots. When these boots have inflated and deflated, the cycle is complete.

When the switch is held in the MANUAL position, all the boots will inflate simultaneously and remain inflated until the switch is released. The switch will return to the OFF position when released. After the cycle, the boots will remain in the vacuum hold-down condition until again actuated by the switch.

System operation can be monitored with the green WING DEICE and TAIL DEICE annunciators. These annunciators illuminate during the period the boots are inflated to indicate proper operation.

For most effective deicing operation, allow at least 1/2 inch (1.27 cm) of ice to form before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding. Subsequent cyclings of the boots will then have a tendency to build up a shell of ice outside the contour of the leading edge, thus making ice removal efforts ineffective.

2.24.5 Stall Warning Vane Heat

The lift transducer is equipped with anti-icing capability on both the mounting plate and the vane. The heat is controlled by a switch located on the Left Subpanels (Figure 2-4) placarded STALL WARN. The level of heat is reduced for ground operation, but is automatically increased for flight operation through the left landing gear safety switch.

WARNING

The heating elements protect the lift transducer vane and face plate from ice. However, a buildup of ice on the wing may change or disrupt the airflow and prevent the system from accurately indicating an imminent stall. Remember that the stall speed increases whenever ice accumulates on any airplane.

2.24.6 Fuel Vent Heat

Heating elements are installed in the fuel vents located on the underside of each wing. Each heating element is controlled by an individual circuit breaker switch placarded FUEL VENT-LEFT-RIGHT, located on the Left Subpanels (Figure 2-4).

2.24.7 Fuel Heat

An oil-to-fuel heat exchanger, located on the engine accessory case, operates continuously and automatically to heat the fuel sufficiently to prevent ice from collecting in the fuel control unit.

2.24.8 Brake Deice

High temperature engine compressor bleed air is directed onto the brake assemblies by a distributor manifold on each main landing gear. This high pressure air is supplied by the standard bleed air pneumatic system which also provides regulated pressure to the surface deice system and vacuum source. High temperature air from the pneumatic system is routed through a solenoid control valve in each main wheel well through a flexible hose on the main gear strut, and to the distribution manifold around the brake assembly.

A switch on the Left Subpanels (Figure 2-4), placarded BRAKE DEICE, controls the brake deice system. When this switch is activated, both solenoid control valves are opened and green L and R BK DEICE ON annunciators on the caution/advisory status panel are illuminated to advise the system is in operation.

The brake deice system may be operated as required on a continuous basis with the landing gear extended, provided the appropriate limitations are observed. To avoid excessive wheel well temperatures with the landing gear retracted, a timer is incorporated to automatically terminate system operation approximately ten minutes after the landing gear is retracted. The system annunciators should be monitored and the control switch selected OFF when the annunciators extinguish, or if brake deice operation has not automatically terminated within approximately ten minutes. The landing gear must be extended before the timer is reset and the system can be activated again.

Brake deice valves will give better service and have longer service life if they are cycled on some regular basis throughout the year. Long periods of valve inactivity can cause accumulation of contaminants around the valve mechanism, causing it to seize, or preventing complete closure. The brake deice system should be cycled as part of the maintenance engine runups, and once during each flight operation. Besides keeping the valves functional, this procedure will give you the assurance that the system will work properly when it is needed.

2.25 COMFORT FEATURES

2.25.1 Toilet

The forward facing toilet is installed in the baggage compartment. Access is gained to the toilet by raising the hinged lid.

2.25.2 Relief Tubes

A relief tube is provided on the baggage compartment wall forward of the forward facing toilet.

A valve lever is located on the side of the relief tube horn. This valve lever must be depressed at all times while the relief tube is in use.

Note

The relief tubes are for use during flight only.

2.26 CABIN FEATURES

2.26.1 Cabin AC Power Outlets

The airplane is equipped with four AC power outlets to provide 115Vac to be used to supply power for laptop computers. The outlets are located on each side of the cabin beneath the cabin tables. Lift the cover placarded 115Vac to access the outlets.

One 115V, 60 Hz inverter provides the power for the outlets. The inverter is located in the right center section wing just outboard of the nacelle. Input power (28Vdc) comes from the left generator bus through a circuit breaker placarded INVERTER located in the DC Power Distribution Panel under the center aisle floor. The inverter output is protected with a circuit breaker placarded 115VAC - 5 AMP adjacent to the inverter.

The Furnishings switch in the overhead panel controls the inverter input power. The Furnishings switch has three-positions and is placarded FURN COFFEE ON - FURN ON - OFF. The inverter operates when the Furnishings switch is in the FURN COFFEE ON or FURN ON position.

For normal operation, input current to the inverter can vary from approximately 0.5 amperes to approximately 20 amperes depending on the load connected to the outlets. The inverter is capable of providing a continuous output of 4 amperes. The total electrical load connected to the four outlets must not exceed 4 amperes. Excess load may cause the inverter input circuit breaker to open.

The inverter will shutdown for input over voltage, under voltage and high internal temperature conditions. It will automatically reset when the conditions are corrected. The inverter will also shutdown for an output short circuit. Following a short circuit shutdown, the inverter can be manually reset by turning the Furnishings switch OFF and ON.

2.26.2 Fire Extinguishers

Two portable fire extinguishers are installed, one under the copilots seat and one mounted on the aft bulkhead to the right of the airstair door.

CHAPTER 3

Servicing and Handling

3.1 GROUND HANDLING

3.1.1 Towing

The tow bar connects to the upper torque knee fitting of the nose strut. The airplane is steered with the tow bar when moving the airplane by hand, or an optional tow bar is available for towing the airplane with a tug. Although the tug will control the steering of the airplane, someone should be positioned in the pilots seat to operate the brakes in case of an emergency.

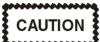


Always make sure that the control locks are removed before towing the airplane. Serious damage to the steering linkage can result if the airplane is towed while the control locks are installed. Do not tow the airplane with a flat shock strut.

The nose gear strut has turn limit warning marks to warn the tug driver when turning limits of the gear will be exceeded. Damage will occur to the nose gear and linkage if the turn limit is exceeded. The maximum nose wheel turn angle is 48° left and right. When ground-handling the airplane, do not use the propellers or control surfaces as hand holds to push or move the airplane.

3.1.2 Parking

The parking brake may be set by pulling out the parking brake control, located on the extreme left side, below the pilots subpanel, and depressing the toe portion of the pilots rudder pedals. The parking control closes dual valves in the brake lines that trap the hydraulic pressure applied to the brakes and prevents pressure loss through the master cylinders. To release the parking brake, depress the pilots brake pedals to equalize the pressure on both sides of the parking brake valves and push the parking brake control fully in.



- Avoid setting the parking brake when the brakes are hot from severe usage, or when moisture conditions and freezing temperatures could form ice locks.
- The parking brake should be left off and wheel chocks installed while the airplane is unattended. Changes in ambient temperature can cause the brakes to release or to exert excessive pressures.

3.1.3 Tie-Down

Three mooring eyes are provided: one underneath each wing, and one in the ventral fin. To moor the airplane, chock the wheels fore and aft, install the control locks, and tie the airplane down at all three points. If extreme weather is anticipated, it is advisable to nose the airplane into the wind before tying it down. Install engine inlet and exhaust covers, propeller tie-down boots (one blade down), and pitot mast covers when mooring the airplane.

WARNING

Unrestrained propellers are apt to windmill. Prolonged windmilling at zero oil pressures can result in bearing damage. Windmilling propellers are a SAFETY HAZARD.

3.2 SERVICING

3.2.1 External Power

The airplane is equipped with an external power receptacle, located just outboard of the right engine in the lower side of the wing center section. The receptacle will accept a standard AN-type plug. The airplane electrical system is automatically protected from reverse polarity (i.e., positive ground) and over voltage.

External power can be used to operate all the airplane electrical equipment (this includes avionic checkouts) during ground operations without the engine running, and it can be used to start the engines. A switch in the external power installation, activated by the insertion of the external power plug of the ground power unit, illuminates an amber EXT PWR caution annunciator on the caution/advisory annunciator panel. The annunciator will flash when the external power plug is engaged and when external power voltage is low. The EXT PWR annunciator will be illuminated continuously when the external power voltage is high enough to prevent battery discharge. The external power unit should be capable of producing 1000 amperes for 5 seconds, 500 amperes for 2 minutes and 300 amperes continuously. A maximum continuous load of 350 amperes will damage the external power relay and power cables of the airplane.



Any current in excess of 1,000 amperes may overtorque the drive shaft of the starter-generator or produce heat sufficient to shorten the life of the unit.

3.2.2 Battery

Servicing the 24-volt, sealed, lead-acid battery is limited to recharging an inadvertently discharged battery and scheduled capacity checks.

3.2.3 Hydraulic System

The hydraulic system reservoir and accumulator are located in the left center section. The accumulator pressure should be maintained at 800 ± 50 psi.

The reservoir cap incorporates a dipstick marked in degrees Fahrenheit; the fluid level should be at its corresponding temperature.

3.2.4 Tires

The airplane is equipped with dual tires on the main gear, and a single tire on the nose gear. Each main gear is equipped with 22 x 6.75-10, 10-ply-rated tubeless tires and a 22 x 6.75-10, 8-ply-rated tubeless tire is installed on the nose gear.

Inflate the main wheel tires to 97 + 5/-0 psi. Inflate the nose wheel tire to between 55 and 60 psi.

3.2.5 Brake System

Brake servicing is limited to maintaining adequate fluid in the reservoir. A dipstick is provided as part of the reservoir lid to measure the fluid level. When the fluid is low, add sufficient quantity of approved hydraulic fluid to raise the level to the full mark on the dipstick.

Brake assemblies are equipped with automatic adjusters to assure a positive clearance between disc and lining when the brakes are not applied.

3.2.6 Oil System

Do not mix different oil brands together. Total oil tank capacity is 11 U. S. quarts (10.4 liters). When a dry engine is first serviced, it will require approximately 5 quarts (4.7 liters) in addition to tank capacity to fill the lines and cooler, giving a total system capacity of 14 U.S. quarts or 3.5 U.S. gallons (13.2 liters). The engine will trap approximately 1.5 quarts (1.4 liters) which cannot be drained.



The normal oil level is at the one quart mark. Overfilling may cause a discharge of oil through the breather until a satisfactory level is reached.

3.2.7 Fuel System

3.2.7.1 Fuel Handling Practices

All hydrocarbon fuels contain some dissolved, suspended water. The quantity of water contained in the fuel depends on temperature and the type of fuel. Kerosene, with its higher aromatic content, tends to absorb and suspend more water than aviation gasoline. Along with the water, it will suspend rust, lint, and other foreign materials longer. Given sufficient time, these suspended contaminants will settle to the bottom of the tank. However, the settling time for kerosene is five times that of aviation gasoline. Due to this fact, jet fuels require good fuel handling practices to assure that the airplane is serviced with clean fuel. If recommended ground procedures are carefully followed, solid contaminants will settle and free water can be reduced to 30 parts per million (PPM), a value that is currently accepted by the major airlines. Since most suspended matter can be removed from the fuel by sufficient settling time and proper filtration, it is not a major problem. Dissolved water has been found to be the major fuel contamination problem. Its effects are multiplied in airplanes operating primarily in humid regions and warm climates.

Dissolved water cannot be filtered from the fuel with micronic type filters, but can be released by lowering the fuel temperature, such as will occur in flight. For example, a kerosene fuel may contain 65 ppm (8 fl oz per 1,000 gallons) of dissolved water at 80 °F (26 °C). When the fuel temperature is lowered to -9 °C, only about 25 ppm will remain in solution. The difference of 40 ppm will have been released as supercooled water droplets which need only a piece of solid contaminant or an impact shock to convert them to ice crystals. Tests indicate that these water droplets will not settle since the specific gravity of ice is approximately equal to that of kerosene. The 40 ppm of suspended water seems like a very small quantity, but when added to suspended water in the fuel at the time of delivery, is sufficient to ice a filter. While the critical fuel temperature range is from -18 °C to -29 °C, which produces severe system icing, water droplets can freeze at any temperature below 0 °C.

Water in jet fuel also creates an environment favorable to the growth of microbiological sludge in the settlement areas of the fuel cells. This sludge, plus other contaminants in the fuel, can cause corrosion of metal parts in the fuel system as well as clogging of the fuel filters.

Since fuel temperature and settling time affect total water content and foreign matter suspension, contamination can be minimized by keeping equipment clean. Use adequate filtration equipment and careful water drainage procedures, store the fuel in the coolest areas possible, and allow adequate settling time. Underground storage is recommended for fuels. Filtering the fuel each time it is transferred will minimize the quantity of suspended contaminants carried by the fuel.



Fuel spilled on tires has a deteriorating effect, so tires should be cleaned promptly.

3-3

3.2.7.1.1 Filling The Tanks

When filling the airplane fuel tanks, always observe the following:

- 1. Ensure the airplane is statically grounded to the servicing unit via the plug-in jacks near the auxiliary and main filler locations, and that the airplane and servicing unit are both grounded to the ground.
- 2. The main filler cap is located on top of the outboard wing section, the auxiliary filler cap is located on top of the center wing section, and the extended range fuel cap is on top located on the forward end of the extended range fuel tank. Do not rest fuel nozzle in tank filler neck, because this may damage the filler neck.



Fuel tanks must be filled in sequential order starting with the main tanks and then auxiliary tanks, and lastly the extended range tanks.

3. Allow a three-hour settle period whenever possible, then drain a small amount of fuel into a container from each drain point. Check fuel at each drain point for contamination.

3.2.7.2 Fuel Grades And Types

Aviation Kerosene Grades F-24, Jet A, Jet A-1, Jet B, JP-4, JP-5, and JP-8 may be mixed in any ratio. Aviation Gasoline Grade 100LL is an approved emergency fuel and may be mixed with the recommended fuels in any ratio; however, use of the lowest octane rating available is recommended. Operation on Aviation Gasoline shall be limited to 150 hours per engine during each time-between-overhaul (TBO) period. Refer to Chapter 4, Operating Limitations, for additional limitations on the use of Aviation Gasoline and Fuel Additives.



Do not allow the fuel cells to dry out and crack. At a later servicing, the cracks would allow fuel to diffuse through the walls of the fuel cell. If any fuel cell is to remain empty for an extended interval, ensure that the fuel cells last contained jet fuel; if the fuel cells last contained aviation gasoline, coat them with oil.

em with oil.

Figure 3-1. Fuel Reference Chart

	FLIP CODE	US MIL CODE	NATO CODE	COMMERCIAL	FREEZE POINT (°C [°F])	WT @ 15C (LBS/GAL)	COMMENTS
PRIMARY	J5	JP-5	F-44	NONE	-46 [-51]	6.8	
FUELS	J8	JP-8	F-34	NONE	-47 [-53]	6.7	
	A++	F-24	F-24	NONE	-40 [-40]	6.7	1
	N/A	TS-1	NONE	TS-1	-50 [-58]	6.7	2
	A1	NONE	F-35	JET A-1	-47 [-53]	6.7	3
	Α	NONE	NONE	JET A	-40 [-40]	6.7	1, 3
	J4	JP-4	F-40	NONE	-58 [-72]	6.5	3
	В	NONE	NONE	JET B	-58 [-72]	6.5	3
EMERGENCY	J8+100	JP-8+100	F-37	NONE	-47 [-53]	6.7	3, 4
FUELS	A++100	F-27	F-27	NONE	-40 [-40]	6.7	1, 3, 4
	100LL	NONE	F-18	100LL	-58 [-72]	6.0	3, 4

Figure 3-1. Fuel Reference Chart (cont.)

FUEL DEFINITIONS:

PRIMARY FUEL — Fuel that the aircraft is authorized to use for continuous unrestricted operations.

EMERGENCY FUEL — Fuel which may be used when no other primary fuel is available in case of emergency or operational necessity.

COMMENTS:

- 1. JET-A, F-24, and F-27 (F-24+100) fuel freeze point of -40 °C (-40 °F) is warmer than that of other jet fuels.
- Only TS-1 supplied from US and NATO military installations has the approved military additive package and is authorized for use.



PRIST injected into the fuel from aerosol cans as it is pumped into the aircraft is not recommended. It does not mix well with the fuel, has a tendency to settle to the bottom of tanks, and may damage fuel system seals and fuel tank materials.

Note

If PRIST is injected via aerosol cans, special attention should be paid to low point drain samples for signs of deteriorating fuel cells, i.e. fuel cell coatings, bladder material, or corrosion-born material. Injection of aerosol PRIST increases the risk of deterioration.

3. The aircraft shall be conspicuously placarded with the emergency fuel grade and maintenance departments shall be informed when serviced with any emergency fuel.

For additional information on aviation fuels, consult the following:

- 1. NAVAIR 00-80T-109, Aircraft Refueling NATOPS Manual.
- 2. MIL-HDBK-844B (AS), Refueling Handbook For Navy/Marine Corps Aircraft.

3.2.8 Adding Biocide to Fuel

Refer to the Model B300/B300C Maintenance Manual and to the latest revision of Pratt & Whitney Canada Engine Service Bulletin No. 13044 for concentrations to use, and for procedures, recommendations, and limitations pertaining to the use of biocidal/fungicidal additives in turbine fuels.

3.2.9 Use of Anti-Icing Additive

Request refueler assistance for proper fuel/additive blending during the aircraft refueling. The following procedure will be utilized when blending anti-icing additive, complying with MIL-DTL-85470, as the aircraft is being refueled through wing fillers.

- 1. When using HI-FLO PRIST blender (model PHF-204), remove the cap retaining tube and clip assembly.
- 2. Attach pistol grip on collar.
- 3. Press tube into button.
- 4. Clip tube end to fuel nozzle.
- 5. Start flow of additive when refueling begins. (Refueling should be at 30 gal/min minimum and 45 gal/min maximum.) A rate of less than 30 gal/min may be utilized when topping off tanks.

Ensure that the additive is directed into the flowing fuel stream and that additive flow is started after fuel flow starts and is stopped before fuel flow stops. To ensure full additive flow from the can, pull the trigger firmly and lock it into place. Do not allow concentrated additive to contact the coated interior of fuel cells or aircraft painted surfaces.

Use no less than 20 fluid ounces of additive per 260 gallons of fuel added or more than 20 fluid ounces of additive per 104 gallons of fuel added.



Failure to comply with the above may result in deterioration of fuel system seals and fuel tank materials.

3.2.10 Use of Jet B, JP-4, and Aviation Gasoline

Fuel quantity indicators will not indicate correctly when using Jet B, JP-4, or aviation gasoline due to the differences in their density and dielectric constants. The indicated fuel quantity should be corrected using the factors shown below. These factors have been generalized in some cases for simplicity, thus results should be considered as approximations.

- 1. When using Jet B or JP-4, multiply the indicated fuel quantity by .96 to obtain the corrected fuel quantity.
- 2. When using aviation gasoline, multiply the indicated fuel quantity by .94 to obtain the corrected fuel quantity.

3.3 VACUUM AIR

Vacuum is obtained by operating an ejector with bleed air from the engines. During operation, the ejector draws air in through the vacuum filter. A vacuum-relief regulator valve regulates vacuum pressure.

The vacuum-relief regulator valve, located on the forward pressure bulkhead in the bottom of the avionics compartment, is protected by a foam sponge type filter. If vacuum pressure rises above a normal reading, clean the filter and recheck vacuum pressure before attempting to adjust the valve.

3.4 SERVICING THE OXYGEN SYSTEM

3.4.1 Oxygen Components

Oxygen for unpressurized, high-altitude flight is supplied by a cylinder located in the compartment immediately aft of the aft pressure bulkhead. A 77-cubic-foot (2181 liters) cylinder is installed. The oxygen system is serviced by a filler valve accessible by removing an access plate on the right side of the aft fuselage. The system has two pressure gages, one located on the right subpanel in the crew compartment for in-flight use, and one adjacent to the filler valve for checking system pressure during filling. Refer to Figure 2-26.

A shutoff valve and regulator, located on the cylinder, controls the flow of oxygen to the crew and passenger outlets. The shutoff valve is actuated by a push-pull type control located on the left side of the pedestal in the cockpit. The regulator is a constant-flow type which supplies low pressure oxygen through system plumbing to the outlets.

3.4.2 Filling The Oxygen System

Fill the oxygen system slowly by adjusting the recharging rate with the pressure regulating valve on the servicing cart, because the oxygen, under high pressure, will cause excessive heating of the filler valve. Fill the cylinder to a pressure of $1,800 \pm 50$ psi at a temperature of 21 °C. This pressure may be increased an additional 3.5 psi for each degree of increase in temperature; similarly, for each degree of drop in temperature, reduce the pressure for the cylinder by 3.5 psi. The oxygen system, after filling, will need to cool and stabilize for a short period before an accurate reading on the gage can be obtained. When the system is properly charged, disconnect the filler hose from the filler valve and replace the protective cap on the filler valve.

WARNING

Do not use medical or industrial oxygen. It contains moisture which can cause the oxygen valve to freeze.

3.5 AIR CONDITIONER

If an extended period of time occurs during which the air conditioning system is not operated, moisture may condense and settle in the system low spots, resulting in corrosion of the refrigerant lines. Also, the system seals may dry out, shrink, and crack, due to the lack of lubrication. In order to protect the integrity of the system, the air conditioner should be operated at least 10 minutes every month.



Do not attempt to operate the air conditioner when the ambient temperature is below 10 °C. If for several weeks it is impossible to obtain an ambient temperature of at least 10 °C, the recommended monthly interval for operating the air conditioner may be extended somewhat.

3.5.1 Cabin Air Filters

A flexible, fiberglass-type air filter covers the coils of the forward air conditioner evaporator. When an aft evaporator is installed, another flexible filter is used at the aft evaporator coils. A foam-rubber type recirculated-air filter is also installed over the return-air valve, at floor level forward of the copilots rudder pedals.

3.6 MISCELLANEOUS MAINTENANCE

The miscellaneous maintenance section includes maintenance activities not previously covered in this chapter.

3.6.1 Cleaning

3.6.1.1 Windows

The plastic windows should be kept clean and waxed. To prevent scratches, wash the windows carefully with plenty of mild soap and water, using the palm of the hand to dislodge dirt and mud. Flood the surface with clean water to rinse away dirt and soap. After rinsing, dry the windows with a clean, moist chamois. Rubbing the surface of the plastic with a dry cloth should be avoided, as it builds up an electrostatic charge on the surface, which attracts dust particles.

If oil or grease is present on the surface of the plastic, remove it with a cloth moistened with kerosene, aliphatic naptha, or hexene, then rinse the surface with clear water. Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire-extinguisher or anti-ice fluid, lacquer thinner, or glass cleaner. These materials will soften the plastic and may cause it to craze.

If it is desired to use a commercial cleaner to clean the plastic windows, use only cleaners that are approved by Hawker Beechcraft Corporation and follow the directions on the container. It will not be necessary to apply wax to windows after use of commercial cleaners, as these cleaners contain wax, as well as cleaning agents.

After thoroughly cleaning, wax the surface with a good grade of commercial wax that does not have an acrylic base. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft, flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the plastic.

3.6.1.2 Windshields

Glass windshields with antistatic coating should be cleaned as follows:

- 1. Wash excessive dirt and other substances from the glass with clean water.
- 2. Clean the windshield with mild soap and water or a 50/50 solution of isopropyl alcohol and water. Wipe the glass surface in a straight rubbing motion with a soft cloth or sponge. Never use any abrasive materials or any strong acids or bases to clean the glass.
- 3. Rinse the glass thoroughly and dry, but do not apply wax.

3.6.1.3 Polarized Cabin Windows

The polarized cabin windows consist of two plastic window panels installed with the polarized surfaces facing each other in a sealed assembly. To clean the interior exposed surface of the window requires only careful application of the practices for cleaning plastic windows. If it should become necessary to clean the inner surface of the sealed assembly and the inside of the pressure glass, remove the complete window panel.

3.6.1.4 Cockpit Side Windows (Anti-Fog)

The interior surface of cockpit (crew) side windows utilizes an "anti-fog" coating which cannot be cleaned by the methods specified for windshields and cabin side windows without damaging the anti-fog surface. These windows require special care when cleaning is required. The following methods and materials have been found to be acceptable in cleaning the anti-fog coating. The use of other materials may cause loss of anti-fog protection or obscure vision through the window.

1. The commercial product Windex Glass Cleaner may be used. Shake the bottle well, spray on, remove with a soft cloth such as flannel or a plexiwipe cloth using light hand pressure.



Do not allow Windex to contact the surfaces of uncoated acrylic windows. Adjacent uncoated windows should be papered over or otherwise protected.

2. Commercial liquid detergents such as LUX or JOY dissolved in warm water may be used to clean the anti-fog coatings. This solution is applied and rinsed with clean water, then wiped dry with a soft cloth or a clean, damp chamois.

3.6.1.5 Surface Deice Boot

The deice boots are made of soft, flexible stock, which may be damaged if fuel hoses are dragged over the surface of the boots or if ladders and platforms are rested against them. Keep deice boots free of oil, fuel, paint remover, solvents, and other injurious substances. Deice boots should be cleaned regularly with a mild soap and water solution.

3.6.2 Interior Care

3.6.2.1 Leather or Vinyl

Dust occasionally. To remove almost any stain, wash it in accordance with the following:

Note

Never use saddle soap, furniture polishes, oils, varnishes, ammonia water, or solvents of any kind.

- 1. Use lukewarm water.
- 2. With Castile, Ivory or any other mild soap, work up a thin layer of suds on a piece of cheesecloth, and apply to the stained area.
- 3. With a piece of cheesecloth dampened in clean water, remove the soap film.

4. Dry the dampened area with a dry, soft cloth.



The colors of many leathers may only be accomplished by surface dye processing. The color may be rubbed off by continuously dragging hard or coarse material across the leather. While working in the cabin, use protective covers on the leather upholstery. Use only mild detergent with a soft cloth to clean soiled leather.

3.6.2.2 Fabrics

Dust has impurities which affect fabrics. Vacuum fabrics often. Dry cleaning should be done at regular intervals before excessive soil accumulates. The actual cleaning of draperies and upholstery must be performed by a professional dry cleaner. Very few fabrics are washable.

3.6.2.3 Laminate

The decorative surface may be readily cleaned with warm water and mild soap. The use of abrasive or "special" cleansers should be avoided. Stubborn stains may be removed with organic solvents or two minutes exposure to a hypoclorite bleach such as "Clorox," followed by a clean water rinse.

CHAPTER 4

Operating Limitations

4.1 INTRODUCTION

This chapter includes all the important limits and restrictions that shall be observed during ground and flight operations. The operating limitations set forth are the direct result of design analysis and testing, and have been approved by the Federal Aviation Administration.

4.2 AIRSPEED LIMITATIONS

SPEED	KCAS	KIAS	REMARKS
Maneuvering Speed (V _A)	182	182	Do not make full or abrupt control movements above this speed.
Maximum Flap Extension/ Extended Speed (V _{FE}):			Do not extend flaps or operate with flaps extended above these speeds.
Approach	200	202	
Full Down	155	158	
Maximum landing Gear Operating Speed (V_{LO}):			Do not extend flaps or retract landing gear above these speeds.
Extension	182	182	
Retraction	164	164	
Maximum landing Gear Extended Speed (V_{LE})	182	182	Do not exceed this speed with landing gear extended.
Air Minimum Control Speed (V _{MCA}):			These are the lowest airspeeds at which the airplane is directionally controllable
Propeller Feathered:			when one engine suddenly becomes inoperative, with autofeather armed, and
Flaps Up	103	101	the other engine at take-off power.
Flaps Approach	99	98	
Maximum Operating Speed (V _{MO}):			
Sea Level to 24,000 feet	245	245	These speeds may not be deliberately exceeded in any flight regime.
24,000 to 35,000 feet	245 to 192*	245 to 192*	Red pointer reflects V _{MO} /M _{MO} .
	*0.58 Mach		

4.3 AIRSPEED INDICATOR DISPLAY

DISPLAY	KIAS VALUE OR RANGE	SIGNIFICANCE
Red Line	101	Air Minimum Control Speed (V _{MCA})
Solid Red Bar (at bottom of airspeed scale)		ISS LSC* Marker. The top of the marker changes with flap position to reflect the following stall speeds.
	82	Stalling Speed (V_{S0}) at maximum weight with flaps down and idle power.
	91	Stalling Speed (V_{S1}) at maximum weight with flaps approach and idle power.
	99	Stalling speed (V_{S1}) at maximum weight with flaps up and idle power.
■ DN (white)	158	Maximum speed permissible with flaps extended beyond approach.
◀ APP (white)	202	Maximum speed permissible with flaps in approach position.
Blue Line	135	One-Engine-Inoperative Best Rate-of-Climb Speed.
Solid Red Bar (at top of airspeed scale):		V _{MO} Marker. The bottom of the Marker represents the Maximum Operating Speed. These speeds may not be deliberately exceeded in any flight regime.
Sea Level – 24,000 feet	245	
24,000 – 35,000 feet	245 to 192**	V_{MO}
* Impending Stall Speed Low Sp	peed Cue.	•

^{**} The indicated airspeed decreases with altitude to maintain a constant Mach number of 0.58.

4.4 POWER LEVERS

Do not lift power levers in flight. Lifting the power levers in flight, or moving the power levers in flight below the flight idle position, could result in a nose-down pitch and a descent rate leading to aircraft damage and injury to personnel.

4.5 ENGINE OPERATING LIMITS

The following limitations shall be observed, refer to Figure 4-1. Each column presents limitations. The limits presented do not necessarily occur simultaneously. Refer to the Pratt & Whitney Engine Maintenance Manual for specific actions required if limits are exceeded.



Values for Maximum Cruise torque settings taken from the Performance Supplement shall not be exceeded. Any torque setting above these values will decrease the service life and reliability of the engines and could lead to exceedance of an engine and/or airframe limitation.

Figure 4-1. Engine Operating Limitations

OPERATING CONDITION	TORQUE% (1)	MAXIMUM ITT °C	GAS GENERATOR RPM % N ₁	PROP RPM N ₂	OIL PRESS PSI (2)	OIL TEMP °C (3)(4)
STARTING		1,000 (5)			0 to 200	-40 (min)
IDLE		750 (6)	62 (min)	1,050 (min)	60 (min)	-40 to +110
TAKEOFF	100 (10)	820	104	1,700 (9)	90 to 135	0 to 110
MAX CONT	100 (10)	820	104	1,700 (9)	90 to 135	0 to 110
CRUISE CLIMB	(7) (10)	785	104	1,700 (9)	90 to 135	0 to 110
MAX CRUISE	(7) (10)	820	104	1,700 (9)	90 to 135	0 to 110
MAX REVERSE		760		1,650	90 to 135	0 to 99
TRANSIENT	156 (8)	850 (8)	104	1,870 (8)	200	0 to 110

NOTES:

- 1. Torque limit applies within range of 1,000 to 1,700 propeller rpm (N₂). Below 1,000 propeller rpm, torque is limited to 62%.
- 2. Normal oil pressure is 90 to 135 psi at gas generator speeds above 72%. With engine torque below 62%, minimum oil pressure is 60 psi at normal oil temperature (60 °C to 70 °C).
 - a. Oil pressures under 90 psi are undesirable. Under emergency conditions, to complete a flight, a lower oil pressure limit of 60 psi is permissible at a reduced power level not to exceed 62% torque. Oil pressures below 60 psi are unsafe and require that either the engine be shut down or a landing be made at the nearest suitable airport, using the minimum power required to sustain flight. Fluctuations of plus or minus 10 psi are acceptable.
 - b. During extremely cold starts, oil pressure may reach 200 psi.
 - c. In flight, oil pressures above 135 psi but not exceeding 200 psi are permitted only for the duration of the flight.
- 3. A minimum oil temperature of 55 °C is recommended for fuel heater operation at take-off power.
- 4. Oil temperature limits are -40 °C and +110 °C. However, temperatures between 99 °C and 110 °C are limited to a maximum of 10 minutes.
- 5. This value is time limited to 5 seconds.
- 6. High ITT at ground idle may be corrected by reducing accessory load and/or increasing N₁ rpm.
- 7. Cruise torque values vary with altitude and temperature.
- 8. These values are time limited to 20 seconds.
- 9. To account for power setting accuracy and steady state fluctuations, inadvertent propeller excursions up to 1,735 rpm are time limited to 7 minutes. Refer to Figure 4-2.
- 10. To account for power setting accuracy and steady state fluctuations, inadvertent torque excursions up to 102% are time limited to 7 minutes. Refer to Figure 4-3.

Figure 4-2. Prop RPM Limitations

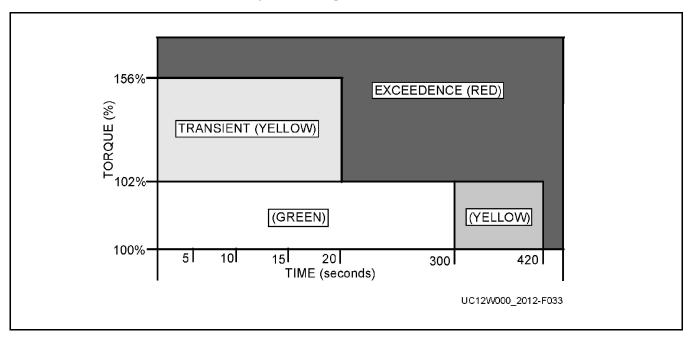
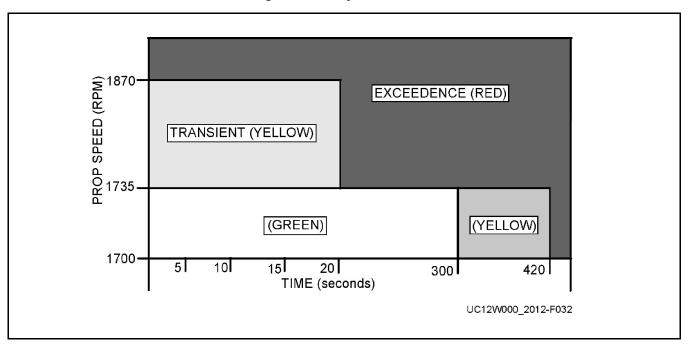


Figure 4-3. Torque Limitations



4.6 EXTERNAL POWER LIMITS

External power carts will be set to 28.0 - 28.4 volts and be capable of generating a minimum of 1,000 amps momentarily and 300 amps continuously.

4.7 GENERATOR LIMITS

Maximum sustained generator load is limited as follows:

- 1. In Flight:
 - a. Sea Level to 34,000 feet altitude 100%.
 - b. Above 34,000 feet altitude 95%.
- 2. Ground Operation:

N_1	MAXIMUM GENERATOR LOAD
62% TO 70%	75%
70% TO 100%	100%

4.8 STARTER LIMITS

Use of the starter is limited to 30 seconds ON, 5 minutes OFF, 30 seconds ON, 5 minutes OFF, 30 seconds ON, then 30 minutes OFF.

4.9 FUEL LIMITS

4.9.1 Approved Engine Fuels

Aviation Kerosene Commercial Grades are Jet A, Jet A-1, Jet B, Military Grades are F-24, JP-4, JP-5, and JP-8 they may be mixed in any ratio.



Do not allow the fuel cells to dry out and crack. At a later servicing, the cracks would allow fuel to diffuse through the walls of the fuel cell. If any fuel cell is to remain empty for an extended interval, ensure that the fuel cells last contained jet fuel; if the fuel cells last contained aviation gasoline, coat them with oil.

4.9.2 Emergency Engine Fuels

Aviation Gasoline Grades 80 Red (80/87), 91/96, 100LL Blue (In some countries, this fuel is colored Green and designated "100L", 100 Green (100/130), and 115/145 Purple are emergency fuels and may be mixed with the recommended fuels in any ratio; however, use of the lowest octane rating available is recommended.

4.10 LIMITATIONS ON THE USE OF AVIATION GASOLINE

- 1. Operation is limited to 150 hours between engine overhauls.
- 2. Operation is prohibited if either standby fuel pump is inoperative.
- 3. Crossfeed capability is required for flight above 20,000 feet pressure altitude (FL200).

4.11 APPROVED FUEL ADDITIVES

4.11.1 Anti-Icing Additive

Anti-icing additive conforming to MIL-I-27686 or MIL-I-85470 may be used.



Prior to refueling, check with the fuel supplier to determine whether or not anti-icing additive has already been added to the fuel. If anti-icing additive is used, it shall be properly blended with the fuel to avoid deterioration of the fuel cell sealant. The additive concentration shall be a minimum of 0.10% and a maximum of 0.15% by volume. To assure proper concentration by volume of fuel on board, blend only enough additive for the unblended fuel.

4.11.2 Fuel Biocide Additive

Fuel biocide-fungicide "BIOBOR JF" in concentrations of 135 ppm or 270 ppm may be used in the fuel. BIOBOR JF may be used as the only fuel additive, or it may be used with the anti-icing additive conforming to MIL-I-27686 or MIL-I-85470 specification. Used together, the additives have no detrimental effect on the fuel system components.

Refer to B300/B300C Maintenance Manual and to the latest revision of Pratt & Whitney Canada Engine Service Bulletin No. 13044 for concentrations to use and for procedures, recommendations, and limitations pertaining to the use of biocidal/fungicidal additives in turbine fuels.

4.12 FUEL MANAGEMENT

4.12.1 Usable Fuel (Gallons x 6.7 = Pounds)

- 1. Quantities shown on the fuel control panel are valid for fuel at 6.7 lbs/gal (.8 kg/ltr).
- 2. Total Usable Fuel Quantity 775 gallons/2,933 liters (5,192 pounds).
 - a. Each Main Fuel Tank System 190 gallons/719 liters (1,273 pounds).
 - b. Each Auxiliary Fuel Tank 79.5 gallons/301 liters (533 pounds).
 - c. Each Extended Range Fuel Tank 118 gallons/446 liters (790 pounds).

4.12.2 Fuel Imbalance

Maximum allowable fuel imbalance between wing fuel systems is 300 pounds (136 kg).

4.12.3 Fuel Crossfeed

Crossfeeding of fuel is permitted only when one engine is inoperative.



One operative standby fuel pump is required for takeoff when using approved engine fuels, but in such a case, crossfeed of fuel will not be available from the side of the inoperative standby fuel pump. Two operative standby fuel pumps are required for takeoff when operating on emergency engine fuels.

4.12.4 Fuel Gages in the Yellow Arc

Do not take off if fuel quantity gages indicate in yellow arc or indicate less than 265 pounds (120 kg) of fuel in each wing system.

4.12.5 Extended Fuel

Do not put any fuel into the extended range tanks unless both the auxiliary and main tanks are full.

4.12.6 Auxiliary Fuel

Do not put any fuel into the auxiliary tanks unless the main tanks are full.

4.12.7 Operating With Low Fuel Pressure

Operation of either engine with its corresponding fuel pressure annunciator (L FUEL PRES LO or R FUEL PRES LO) illuminated is limited to 10 hours before overhaul or replacement of the engine-drive fuel pump. Windmilling time need not be charged against this limit.

4.13 OIL SPECIFICATION

Any oil specified by brand name in the latest revision of Pratt & Whitney Service Bulletin Number 13001 is approved for use in the PT6A-60A engine.

Total Oil Capacity — 14 quarts (3.5 gallons) (13.2 liters) per engine.

Drain And Refill Quantity — Approximately 11 quarts (10.4 liters) per engine.

Oil Quantity Operating Range — MAX to 4 QUARTS (3.8 LITERS) LOW on dipstick. 5 quarts (4.7 liters) marked on dipstick.

4.14 PROPELLER ROTATIONAL SPEED LIMITS

- 1. Transients not exceeding 20 seconds 1,870 rpm.
- 2. Reverse 1,650 rpm.
- 3. All other conditions 1,700 rpm.
- 4. Minimum idle speed 1,050 rpm.

4.15 PROPELLER ROTATIONAL OVERSPEED LIMITS

Sustained propeller overspeeds faster than 1,700 rpm indicate failure of the primary governor. Flight may be continued at propeller overspeeds up to 1,768 rpm, provided torque is limited to 96%. Sustained propeller overspeeds faster than 1,768 rpm indicate failure of both the primary governor and the secondary governor, and such overspeeds are not approved.

4.16 PROPELLER AUTOFEATHER

The propeller autofeather system shall be operable for all flights and shall be armed for takeoff, climb, approach, and landing.

4.17 POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	GREEN DISPLAY NORMAL OPERATING RANGE	YELLOW DISPLAY CAUTION RANGE	MINIMUM/ MAXIMUM-RED DISPLAY				
ITT (starting) °C	< 820 or > 820 < 850 < 20 sec or > 850 < 1,000 < 5 sec		> 820 < 850 > 20 sec or > 850 < 1,000 > 5 sec or > 1,000				
ITT (running) °C	< 820	> 820 < 850 < 20 sec	> 820 < 850 > 20 sec or > 850				
Torque % (Prop RPM more than 1,000)	< 100 or > 100 < 102 for < 5 min	> 102 < 156 < 20 sec or > 100 < 102 for > 5 min < 7 min > 102 > 156 > 20 sec or > 100 < 102 > 7 min or > 156					
Torque % (Prop RPM less than 1,000)	< 62	> 62 < 156 < 20 sec	> 62 < 156 > 20 sec or > 156				
PROP RPM (starting)	< 1,700 or > 1,700 < 1,735 < 5 min	> 1,735 < 1,870 < 20 sec or > 1,700 < 1,735 for > 5 min < 7 min	> 1,735 < 1,870 > 20 sec or 1,700 < 1,735 > 7 min or > 1,870				
PROP RPM (running)	> 1,050 < 1,700 or > 1,700 < 1,735 < 5 min	> 1,735 < 1,870 < 20 sec or > 1,700 < 1,735 for > 5 min & < 7 min or < 1,050	> 1,735 < 1,870 > 20 sec or > 1,700 < 1,735 > 7 min or > 1870				
% N1 (starting)	< 104		> 104				
% N1 (running)	> 62 < 104	< 62	> 104				
FUEL FLOW	> 0 < 800						
OIL TEMP (starting) °C	> -40 < 99	> 99 < 110 < 10 minutes	> 99 < 110 > 10 min or < -40 or > 110				

INSTRUMENT	GREEN DISPLAY NORMAL OPERATING RANGE	YELLOW DISPLAY CAUTION RANGE	MINIMUM/ MAXIMUM-RED DISPLAY
OIL TEMP (running) °C	> 0 < 99	> 99 < 110 < 10 minutes or < 0	> 99 < 110 > 10 min or > 110
OIL PRESS (psi)	> 90 < 135	> 60 < 90 or > 135 < 200	< 60 or > 200

The pilot is responsible for monitoring all engine limits, including transient limits not accounted for by the EIS as defined in Engine Operating Limits.

4.18 MISCELLANEOUS INSTRUMENT MARKINGS

4.18.1 Fuel Quantity Indicators

Yellow Arc (No-Takeoff Range) — 0 to 265 pounds.

4.18.2 Cabin Differential Pressure Gage

- 1. Green Arc (Normal Operating Range) 0 to 6.6 psi.
- 2. Red Arc (Unapproved Operating Range) 6.6 psi to end of scale.

4.18.3 Pneumatic Pressure Gage

- 1. Green Arc (Normal Operating Range) 12 to 20 psi.
- 2. Red Line (Maximum Operating Limit) 20 psi.

4.18.4 Vacuum Gage

- 1. Narrow Green Arc (Normal from 35,000 to 15,000 feet) 2.8 to 4.3 in. Hg.
- 2. Wide Green Arc (Normal from 15,000 feet to Sea Level) 4.3 to 5.9 in. Hg.
- 3. 35K marked on face of gage at 3.0 in. Hg.
- 4. 15K marked on face of gage at 4.3 in. Hg.

4.18.5 Propeller Deice Ammeter

Green Arc (Normal Operating Range) — 26 to 32 amperes.

4.19 WEIGHT LIMITS

- 1. Maximum Ramp Weight 16,600 pounds (7,530 kg).
- 2. Maximum Takeoff Weight 16,500 pounds (7,484 kg) or as limited by Performance Limitations. Refer to A1-C12WA-NFM-200, Performance Data Supplement.
 - a. Maximum Take-off Weight to Achieve Take-off Climb Requirements.
 - b. Maximum Take-off Weight As Limited By Tire Speed.
 - c. Take-off Field Length.
- 3. Maximum Landing Weight 15,675 pounds (7,110 kg).
- 4. Maximum Zero Fuel Weight 13,000 pounds (5,897 kg).

5. Maximum Weight in Baggage Compartment — 550 pounds (250 kg) total. With toilet installed maximum allowable baggage weight is 510 pounds (232 kg).

4.20 CENTER OF GRAVITY LIMITS

4.20.1 Aft Limit

208.0 inches (5,283 mm) aft of datum at all weights.

4.20.2 Forward Limits

191.4 inches (4,861 mm) aft of datum at 11,800 pounds (5,352 kg) or less, with a straight line variation to 203.2 inches (5,161 mm) aft of datum at 16,500 pounds (7,484 kg).

4.20.3 Datum

The leading edge of the MAC is at F.S. 186.01. The MAC length is 69.43 inches (1,763 mm).

4.20.4 Mean Aerodynamic Chord (MAC)

The leading edge of the MAC is at F.S. 186.01. The MAC length is 69.43 inches (1,763 mm).

4.21 MANEUVER LIMITS

The UC-12W is a Commuter Category Airplane. Acrobatic maneuvers, including spins, are prohibited.

4.22 FLIGHT LOAD FACTOR LIMITS

FLAPS UP	FLAPS DOWN					
3.01 positive g's	2.0 positive g's					
1.24 negative g's	0.00 g					

4.23 MINIMUM FLIGHT CREW

Crew — Two (2), Pilot and Copilot.

4.24 MAXIMUM OCCUPANCY LIMITS

Passengers — Nine (9), (Refer to Chapter 23, Weight and Balance, for approved seating configurations).

4.25 MAXIMUM OPERATING ALTITUDE LIMITS

- 1. Takeoff and Landing Operations Maximum Airfield Elevation (Pressure Altitude).
 - a. Refer to A1-C12WA-NFM-200 Performance Data Supplement.
- 2. Normal Operation 35,000 feet.
- 3. Yaw Damp System:
 - a. Inoperative 5,000 feet.
 - b. Operative On above 5,000 feet, except for takeoff and landing.
- 4. Operation with Aviation Gasoline:
 - a. Both Standby Fuel Pumps Operative 35,000 feet.
 - b. Either Standby Fuel Pump Inoperative Flight Prohibited.

c. Climbs without Crossfeed Capability — 20,000 feet.

4.26 MAXIMUM OUTSIDE AIR TEMPERATURE LIMITS

- 1. Sea Level to 25,000 feet pressure altitude ISA + 37 °C.
- 2. Above 25,000 feet pressure altitude ISA + 31 °C.

4.27 CABIN PRESSURIZATION LIMIT

Maximum Cabin Pressure Differential — 6.6 psi.

4.28 SYSTEMS AND EQUIPMENT LIMITS

4.28.1 Rudder Boost

Shall be operational for all flights.

4.28.2 Landing Gear Cycle Limits

Landing gear cycles (1 up - 1 down) are limited to one every 5 minutes for a total of 6 cycles, followed by a 15-minute cool-down period.

4.28.3 Forward-Facing Executive Seat

For takeoff and landing, an occupied forward-facing seat shall be located in the full aft and full outboard position with seat back upright and the headrest extended to support occupant's head.

4.28.4 Aft-Facing Executive Seat

For takeoff and landing, an occupied aft-facing seat shall be located in the full forward and full outboard position with seat back upright and headrest extended to support occupant's head.

4.28.5 Standard (Non-Executive) Seat Limits

All standard seats must have their seat backs in the upright position for Taxi, Takeoff and Landing.

4.28.6 Air Conditioning Limitations

- 1. The supplemental electric heater shall be off for at least two minutes prior to and during engine start.
- 2. Do not operate the electric heat with the pedestal floor outlet blocked or the cockpit door closed.

4.28.7 Reduced Vertical Separation Minimum (RVSM) Airspace

4.28.7.1 RVSM Equipment

The following equipment must be installed and operational to enter RVSM airspace:

DESCRIPTION					
#1 Air Data Computer (Pilots ADC) and #1 Altitude Display (Pilots ALT)					
#2 Air Data Computer (Copilots ADC) and #2 Altitude Display (Copilots ALT)					
Altitude Preselector/Alerter					
Automatic Altitude Control System					
Transponder					

Any deviation from this equipment list invalidates the RVSM approval status of this airplane; however, operations outside of RVSM airspace may be conducted as required.

4.28.7.2 Pilot's Static Air Source

The pilots static air source select switch must remain in the NORMAL setting during normal operation in RVSM airspace. The ALTERNATE setting is not corrected for static source error; therefore, it is not RVSM compliant.

4.28.7.3 Altitude Display Differences

During normal operations within RVSM airspace, the pilots and copilots displayed altitudes must remain within 200 feet of each other at all times (as a minimum, cross-cockpit altimeter checks should be performed hourly). If the pilots and copilots displayed altitudes deviate by more than 200 feet, RVSM operation is NOT permitted.

4.28.7.4 Altitude Reporting

During normal RVSM operations, the altimetry system being used to control the aircraft should provide input to the altitude-reporting transponder transmitting information to ATC.

4.28.7.5 Automatic Altitude Control

During normal RVSM operations, the autopilot must be able to maintain altitude within ± 65 feet of the assigned flight level at all times when in steady, level flight in non-turbulent conditions. If the autopilot cannot maintain ± 65 feet from the assigned flight level, follow the abnormal procedure in paragraph 13.16.21.4, Inability Of Automatic Altitude Control System To Maintain ± 65 Feet From Assigned Flight Level During RVSM Operation.

4.29 ICING LIMITATIONS

4.29.1 Icing Limitations

- 1. Minimum Ambient Temperature for Operation of Deicing Boots is -40 °C.
- 2. Minimum Airspeed for Sustained Icing Flight 140 knots.
- 3. Sustained flight in icing conditions with flaps extended is prohibited except for approach and landings.
- 4. ENGINE ANTI-ICE, LEFT and RIGHT, shall be ON for operation in ambient temperatures of +5 °C or below when flight free of visible moisture cannot be assured.
- 5. ENGINE ANTI-ICE, LEFT and RIGHT, shall be OFF for take-off operations in ambient temperatures of above +10 °C.
- 6. Approved Deicing And Anti-icing Fluids.
 - a. ISO 11075 Type I.
 - b. ISO 11078 Type II.
 - c. SAE AMS 1424 Type I.
 - d. SAE AMS 1428 Type II.
 - e. SAE AMS 1428 Type III.
 - f. SAE AMS 1428 Type IV.

4.29.2 Brake Deice

Brake Deice system is not to be operated above 15 °C.

4.30 AVIONICS LIMITS

4.30.1 General

- 1. The following guides must be immediately available to the pilot at all times:
 - a. Operators Guide, Collins Pro Line 21 Avionics System for the Hawker Beechcraft King Air, P/N 523-0790065-003117, dated August 15, 2003 or later revision.
 - b. Operators Guide, Collins FMS-3000 Flight Management System for the Hawker Beechcraft King Air C90GTi/B200CGT/B300, P/N 523-0790066, 6th edition, dated June 6, 2007 or later revision.
 - c. Pilot's Guide for the Electronic Standby Instrument System, Model GH-3100, Goodrich Avionics Systems or L3 Communications P/N TP-560, Rev (-), or later revision.
 - d. Aviation Communication and Surveillance Systems (ACSS) TAWS+ Pilot's Guide, Document No. 8006772-001, dated March 2007, or later revision.
 - e. Operators Guide, Collins IFIS-5000 Integrated Flight Information System, Document No. 523-0806347-005117, 5th edition, dated 4 April 2007, or later revision.
- 2. This NATOPS manual is approved for use with Collins FMS-3000 software version SCID 832-4120-011 or later.
- 3. Operating in the composite mode is limited to training and display failure conditions.
- 4. The pilot and copilot Air Data Computers shall be operative for takeoff.
- 5. AHRS 1 and 2 shall be operative for takeoff.
- 6. The pilot's PFD and MFD and copilot's PFD shall be installed and operational in the normal mode for takeoff.
- 7. The MFD shall be operational prior to engine start.

4.30.2 Autopilot

- 1. During autopilot operations, a pilot shall be seated at the controls with the seat belt and shoulder harness fastened.
- 2. An autopilot preflight check shall be conducted and found satisfactory prior to each flight on which the autopilot is to be used.
- 3. The autopilot minimum engage height after takeoff is 400 feet AGL.
- 4. The autopilot minimum use height during cruise is 1,000 feet AGL.
- 5. The autopilot minimum use height during approach is 79 feet AGL.
- 6. The autopilot minimum use height during steep approach is 160 feet AGL.
- 7. Maximum airspeed for autopilot operation is unchanged from the airplane maximum airspeed (V_{MO}/M_{MO}) .
- 8. The autopilot and yaw damper shall not be used for takeoff and landing.
- 9. Operation of the autopilot system with a pitch trim malfunction is prohibited.
- 10. Do not manually override the autopilot during normal flight.

WARNING

Overriding the autopilot in pitch does not cancel the autopilot automatic trim. If a force is applied to the control column with the autopilot engaged, then automatic trim will run to oppose the applied force. This can lead to a severe out-of-trim condition during any phase of flight.

- 11. The maximum coupled intercept angles are:
 - a. Nav and Localizer Less than 90°.
 - b. Back Course 70°.

4.30.3 Dual FMS-3000 Flight Management System (FMS) with 3rd Trimble GPS

- 1. IFR enroute and terminal navigation is prohibited unless the pilot verifies either the currency of the database or the accuracy of each selected waypoint and navaid by reference to current approved data.
- 2. The FMS position shall be checked for accuracy prior to use as a means of navigation.
- 3. The FMS must not be used for navigation unless it is receiving suitable navigation information from one or more of the following:
 - a. One VOR/DME.
 - b. Two DMEs.
 - c. One GPS.
- 4. During oceanic, enroute and terminal area operation with the FMS DR annunciator illuminated, the flight crew must verify the FMS position using VOR/DME raw data or other appropriate means.
- 5. During periods of dead reckoning, the FMS shall not be used for navigation.
- 6. All FMS navigation operations are approved within the U.S. National Airspace System and latitudes bounded by 60° North latitude and 60° South latitude at any longitude with the AHC-3000 Attitude and Heading Reference System.
 - a. Operation to 70° North latitude is acceptable East of 75° West longitude and West of 120° West longitude.
 - b. Operation to 73° North latitude is acceptable East of 50° West longitude and West of 70° East longitude.
 - c. Operation to 70° South latitude is acceptable except for the 45° between 120° East and 165° East longitude.
 - d. The WGS-84 coordinate reference datum in accordance with the criteria of AC 20-130A, AC 91-49 CHG 1, and AC 120-138A must be used. Satellite navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States.
- 7. FMS based instrument approaches shall be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS-3000 database.
 - a. GPS instrument approaches shall be conducted with GPS integrity monitoring (RAIM) and shall be available by the Final Approach Fix.
 - b. FMS APPR (green) or GPS (green) annunciation on the PFD must be illuminated at the FAF in order to conduct the instrument approach procedure. The Approach must be discontinued if the NO APPR (amber) annunciation is illuminated.

- c. ILS, LOC-BC, LDA, SDF, and MLS approaches using the FMS for final approach guidance are prohibited. If an ILS, LOC-BC, LDA, SDF, and MLS approach is loaded from the database, the pilot must ensure that the active NAV source transitions from FMS to short range NAV prior to the FAF.
- d. When an alternate airport is required by the applicable rules, it shall be served by an approach based on other than GPS navigation, the airplane shall have operational equipment capable of using that navigation aid, and the required navigation aid shall be operational.
- e. IFR Non-Precision Approach is limited to published approaches within the US National Airspace System. Approaches to airports in other airspace are not approved unless authorized by the appropriate governing authority.
- f. The use of manually inserted runway coordinates of FMS Visual Approaches is limited to VFR operations only.
- g. During periods of dead reckoning, the FMS shall not be used for navigation. Pre-departure verification of GPS availability is required for GPS as primary means of navigation before each flight.
- h. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS navigation database. The FMS database must incorporate the current update cycle.

Note

Not all published approaches are in the FMS database. The flight crew must ensure that the planned approach is in the database.

- 8. Use of FMS to capture and track a DME arc outside the published end points is prohibited.
- 9. Fuel management parameters are advisory only and shall not replace the primary fuel quantity indications.
- 10. RNP operations are not authorized, except for RNP-10 airspace as defined in Navigation Capabilities.
- 11. The flight director or autopilot must be used and coupled to VNAV VGP guidance when conducting RNAV instrument approaches using LNAV/VNAV DA minimums.

4.30.3.1 Navigation Capabilities

The Dual FMS-3000 Collins FMS is approved under Technical Standard Orders (TSO) TSO-C115b and TSO-C129a Class B1/C1. On the MFD LRN status page, GPS receiver autonomous integrity monitoring (RAIM) is used to assure that the GPS solution meets the required accuracy criteria that follow:

- 4 nm Oceanic/Remote
- 2 nm Enroute
- 1 nm Terminal
- 0.3 nm Final Approach with 99.9% confidence

The oceanic/remote threshold is used in the North Atlantic region; other remote areas use the enroute threshold.

The measure accuracy limit on the LRN STATUS page indicates the maximum estimated error based on measurement inconsistency. Unless an error is detected by RAIM, this value is always less than the RAIM accuracy limit.

When an error is detected, it is annunciated on the LRN STATUS page. If no other navigation sensors are available, the FMS navigates by dead reckoning. If no error is detected by RAIM, the probable GPS error is shown.

When the FMS is receiving appropriate navigational signals, it meets the accuracy specifications for the following operations:

1. **Oceanic and Remote** — In accordance with AC 20-130A and AC 20-138A, two FMS systems must be operating and receiving usable signals from two operating Collins GPS sensors and used in conjunction with

the Collins Pre-Departure GPS Coverage Predictor Program, CPN 832-3443-008, Rev-, or later revision. For routes approved for single GPS navigation, a single FMS must be operating and receiving usable signals from the single GPS sensor and used in conjunction with the Collins GPS Coverage Predictor Program listed above.

- 2. North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace In accordance with the criteria of AC 91-49 and AC 20-138A, two FMS systems must be operating and receiving usable signals from two operating Collins PS sensors and used in conjunction with the Collins Pre-Departure GPS Coverage Predictor Program, CPN 832-3443-008, Rev -, or later revision.
- 3. **RNP-10 Airspace** In accordance with the criteria of FAA Order 8400.12A without time limitations, the FMS meets the minimum requirements for Required Navigation Performance-10 (RNP-10). Two FMS systems must be operating and receiving usable signals from two operating Collins GPS sensors and used in conjunction with the Collins Pre-Departure GPS Coverage Predictor Program, CPN 832-3443-008, Rev-, or later revision.
- 4. **P-RNAV** In accordance with the criteria of JAA TGL-10 and AC 90-96A, the FMS is capable of P-RNAV operations provided the FMS is not in Dead Reckoning ("FMS DR" displayed on the PFD, MFD, or CDU) and is receiving usable signals from one or more of the following:
 - a. One GPS.
 - b. Multiple DMEs.
 - c. A single DME if auto-tune is selected.

Determine the requirements of the national, area, or local air traffic control agency for determining the availability of GPS RAIM for the intended route of flight prior to departure. Some terminal areas may require dual, operating FMS and GPS equipment.

PRNAV and BRNAV operations utilizing GPS as the only NAV sensor require the following pre-flight planning:

During the pre-flight planning phase, the crew must confirm, for the intended flight (route and time), the availability of receiver autonomous integrity monitoring (RAIM) with the latest information from the U.S. Coast Guard giving details of the satellite non-availability (see http://www.navcen.uscg.gov). The U.S. Notices to Airmen (NOTAM) Office also provides satellite non-availability data. The confirmation of the availability of RAIM should be obtained from the Collins Pre-Departure GPS Coverage Predictor Program, CPN 832-3443-008, Rev -, or later revision. Dispatch should not be made in the event of predicted continuous loss of RAIM of more than 5 minutes for any part of the intended flight. The use of EURO CONTRL AUGUR tool may be used to satisfy this requirement. See http://augur.ecacnav.com/.

- 5. En Route and Terminal, including B-RNAV In accordance with AC 90-45A, AC 90-96A, AMC 20-5, the FMS is capable of en route and terminal operations, including B-RNAV, provided the FMS is receiving usable signals from one or more of the following:
 - a. VOR/DME or multiple DMEs.
 - b. One GPS.
 - c. A single DME if auto-tune is selected.
 - d. FMS must not be in Dead Reckoning (FMS DR displayed on the PFD, MFD or CDU).
- 6. Non-Precision Approach
 - a. RNAV (GPS) Non-Precision Approach In accordance with AC 20-130A, AC 20-138A, AC 90-94, and TSO C129a Class B1/C1, the FMS must be receiving usable signals from (at least) one GPS sensor, and the GPS APPR annunciator must be illuminated at the final approach fix.

Note

Some approaches are not included in the database.

- b. VOR/DME Approach In accordance with TSO C115B, the FMS must be receiving the approach reference VOR/DME station, and the APPR (if GPS not available) or GPS APPR annunciator must be illuminated at the final approach fix.
- 7. **RNAV/SIDS/STARS** The FMS is capable of operations on U.S. Area Navigation (Q) routes, RNAV 1 and RNAV 2, SIDS, and STARS in accordance with the criteria of FAA AC 90-100A, provided that:
 - a. The FMS and GPS have been installed and approved for IFR use in accordance with AC 20-130A.
 - b. The FMS is not in Dead Reckoning (FMS DR not displayed on the PFD, MFD, or CDU).
 - c. The crew has not entered NOTAM's navaids on the CDU VOR/DME CONTROL page.
 - d. The FMS is receiving usable GPS signals (NO GPS RAIM, GPS NOT AVAILABLE, GPS-FMS DISAGREE not displayed on CDU) for procedures requiring GPS or for operators based in GPS capability.
 - e. GPS is required.
 - f. The confirmation of the availability of RAIM should be obtained from the Collins Pre-Departure GPS Coverage Predictor Program, CPN 832-3443-008, Rev -, or later revision.

8. Barometric VNAV —

- a. The FMS VNAV system is capable of operations down to LNAV/VNAV DA minima in accordance with FAA AC 90-97. For a particular approach, GPS must be an active component (NO GPS RAIM, GPS NOT AVAILABLE, GPS-FMS DISAGREE not displayed on CDU) of the aircraft's navigation solution.
- b. In accordance with FAA AC 20-129, the VNAV system is approved for enroute, terminal, and approach operations.

4.30.3.2 FMS VNAV

- 1. When using the VNAV system, the barometric altimeters must be used as the primary altitude reference for all operations.
- 2. Use of VNAV guidance for a V-MDA approach that includes a step-down fix between the final approach fix and missed approach point is prohibited.
- 3. VNAV altitudes must be displayed on the MFD map page or CDU legs page when utilizing VNAV for flight guidance.
- 4. Use of VNAV while conducting a missed approach procedure is prohibited.
- 5. VNAV approach guidance to a DA is not authorized if the reported surface temperature is below the Baro-VNAV minimum temperature limitation specified on the applicable RNAV approach procedure chart.

Note

Barometric VNAV guidance during approach including the approach transition, final approach segment, and the missed approach procedure is not temperature compensated. Operating at uncompensated minimum IFR altitudes will not provide expected terrain and obstacle clearance for temperature below ISA.

4.30.3.3 3rd Trimble GPS

PPS-Y and PPS-MIXED operational modes have not been demonstrated for approach and enroute navigation and therefore are not approved. Normal use with SPS Mode has been satisfactorily demonstrated and therefore is approved for all enroute, terminal and approach operations with the FMS listed in paragraph 4.30.3.1, Navigation Capabilities.

4.30.4 Attitude Heading Reference System (AHRS)

For non-Inertial Reference System (IRS) equipped airplanes, operations based on magnetic heading data are approved for:

- 1. Operation within the U.S. National Airspace System and latitudes bounded by 60° North latitude and 60° South latitude at any longitude.
- 2. Operation to 70° North latitude is acceptable East of 75° West longitude and West of 120° West longitude.
- 3. Operation to 73° North latitude is acceptable East of 50° West longitude and West of 70° East longitude.
- 4. Operation to 70° South latitude is acceptable except for the 45° between 120° East and 165° East longitude.

4.30.5 IFIS-5000 Integrated Flight Information System

- 1. When using the IFIS-5000, the Collins IFIS-5000 Integrated Flight Information System Operators Guide, Document 523-0806347-005117, 5th edition, dated 4 April 2007, or later revision must be available to the flight crew.
- 2. The IFIS-5000 system provides supplemental airplane situational awareness information. Its use as a means for navigational or weather avoidance is not approved.
- 3. Display ranges less than 50 miles shall not be used when the GEO-POL data is selected for display. At shorter ranges, the situational picture provided by this data (i.e., rivers, lakes, oceans and political boundaries) may appear erroneous.
- 4. The use of the airplane symbol on the Electronic Charts is prohibited for navigation.
- 5. The database utilized for the Electronic Charts shall incorporate the current update cycler.
- 6. When using the Electronic Charts, a paper equivalent (or electronic flight bag) shall be on board and accessible to the pilot.

4.30.6 Terrain Awareness and Warning System Plus (TAWS+)

- 1. Navigation shall not be predicated upon use of the Terrain Awareness Display. The terrain display is intended to serve as a situational awareness tool only, and may not provide the accuracy and/or fidelity on which to solely base terrain avoidance maneuvering.
- 2. The Terrain Awareness Display (TAD) shall be inhibited by selecting the TERR INHIB switch light when within 15 nm of takeoff, approach, or landing at an airport not contained in the TAWS+ Airport Database. Refer to ACSS document 8006417 for airports contained in the database. (See "TAWS Airport" in www.acsscustomerservices.com).
- 3. When the FMS is operating in the DR mode, the Terrain Awareness alerting shall be inhibited by selecting the TERR INHIB switch light.

Note

The terrain database, displays and alerting algorithms currently account for limited cataloged human-made obstructions in North America and Europe. If obstacle data is not in the database for a particular obstacle, the Obstacle Awareness alerting is not available for the obstacle.

- 4. The current local QNH altimeter setting shall be entered in the pilot's altimeter for proper terrain alerting. In particular, the TERR INHIB switch light shall be selected when operating in QFE mode.
- 5. The terrain database part number displayed on the MFD by MDC diagnostics shall be 9000280-023 or latest.
- 6. The obstacle database part number displayed on the MFD by MDC diagnostics shall be 9000380-001 or latest.

4.30.7 Traffic Alert and Collision Avoidance System (TCAS II)

- 1. Pilots are authorized to deviate from their current ATC clearance to the extent necessary to comply with a TCAS II resolution advisory (RA).
- 2. If the pilot is advised by Air Traffic Control to disable the altitude reporting function of the transponder, the TCAS II System shall be placed in STBY.

4.30.8 Weather Radar

Do not operate the weather radar when personnel are within the scan arc area or the aircraft is inside a hangar.



The area within the scan arc and within 2 feet (0.65 meters) of an operating TWR-852 system can be a hazardous area. Do not operate the systems in any mode other than standby (STBY) or test (TEST) when the antenna might scan over personnel within that range. Turning the transmitter on while inside the hangar is not advisable.

4.30.9 Mode S Enhanced Surveillance Transponder

The installed Mode S system satisfies the data requirements of the International Civil Aviation organization (ICAO) Doc. 7030/4, Regional Supplementary Procedures for SSR Mode S Enhanced Surveillance in designated European airspace.

The capability to transmit data parameter is designated in Figure 4-4.

Figure 4-4. Mode S Enhanced Surveillance Transponder Capabilities

PARAMETER	AVAILABLE
Barometer Pressure Setting	Yes
Groundspeed	Yes
Indicated Airspeed	Yes
Mach Number	Yes
Magnetic Heading	Yes
Position Lat, Long	Yes
Roll Angle	Yes
Selected Altitude	Yes
Track Angle Rate	Yes
True Airspeed	Yes
True Track Angle	Yes
Vertical rate	Yes

4.30.10 AN/ARC-210 VHF/UHF Radio

Intra-system electromagnetic interference can occur when the AN/ARC-210 V/UHF Radio is operated simultaneously with other communications systems and navigation receiver functions.

- AN/ARC-210 V/UHF Radio and HF-9000 HF Radio HF-9000 HF Radio transmissions can cause garbled voice interference in the AN/ARC-210 V/UHF Radio and broken squelch interference in the ARC-210 SATCOM. Avoid simultaneous operation of the AN/ARC-210 V/UHF Radio and the HF-9000 HF Radio.
- 2. AN/ARC-210 V/UHF Radio and VHF-4000 VHF Radio AN/ARC-210 V/UHF Radio transmissions can cause broken squelch and garbled voice interference in the VHF-4000 VHF Radio. Avoid simultaneous operation of the AN/ARC-210 V/UHF Radio and the VHF-4000 VHF Radio.
- 3. AN/ARC-210 V/UHF Radio and the NAV-4000 VOR/Localizer/Glideslope AN/ARC-210 V/UHF Radio transmissions can cause loss or shift of the NAV-4000 VHF VOR indicator, the Localizer indicator and the Glideslope indicator. Avoid operation of AN/ARC-210 V/UHF Radio while in instrument meteorological conditions in the vicinity of terminal control areas navigating with VOR, Localizer or Glideslope.

4.30.11 HF-9000 HF Radio

Intra-system electromagnetic interference can occur when the HF-9000 HF Radio is operated simultaneously with the VHF-4000 VHF Radio or the NAV-4000 Localizer.

- 1. HF-9000 HF Radio and the NAV-4000 Localizer Transmissions from the HF-9000 HF Radio can cause loss of the NAV-4000 Localizer indicator. Restrict HF Radio transmissions when navigating with the Localizer.
- 2. HF-9000 HF Radio and the VHF-4000 VHF Radio Transmissions from the HF-9000 HF Radio can cause garbled voice interference in the VHF-4000 VHF Radio. Avoid simultaneous operation of the HF-9000 HF Radio and the VHF-4000 VHF Radio.

4.31 OTHER LIMITATIONS

4.31.1 Cargo Limitations

- 1. All cargo shall be properly secured by an FAA-approved cargo restraint system.
- 2. Cargo shall be arranged to permit free access to all exits and emergency exits.

4.31.2 Limitations When Encountering Severe Icing Conditions (Required By FAA AD 98-04-24)

- 1. During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.
 - a. Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.
 - b. Accumulation of ice on the upper surface of the wing, aft of the protected area.
 - c. Accumulation of ice on the engine nacelles and propeller spinners farther aft than normally observed.
- 2. Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.
- 3. All wing icing inspection lights shall be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL)].

4.31.3 Cracked or Shattered Windshield

The following limitations apply when continued flight is required with a cracked outer or inner ply of the windshield.

1. Continued flight with a cracked windshield is limited to 25 flight hours.

- 2. Windshields which have a shattered inner ply will have numerous cracks which will obstruct forward vision and may produce small particles or flakes of glass that can break free of the windshield and interfere with the crew's vision. These windshields shall be replaced prior to the next flight.
- 3. Crack(s) shall not impair visibility.
- 4. Crack(s) shall not interfere with the use of windshield wipers for flights requiring the use of the wipers.
- 5. Windshield Anti-ice shall be operational for flights in icing conditions.
- 6. The following placard shall be installed in plain view of the pilot:

MAXIMUM AIRPLANE ALTITUDE IS LIMITED TO 25,000 FEET. CABIN ΔP SHALL BE MAINTAINED BETWEEN 2.0 AND 4.6 PSI DURING FLIGHT.

Windshields that have cracks in both the inner and outer plies shall be replaced prior to the next flight unless an interim flight clearance is obtained from the Naval Air Systems Command.

4.31.4 Crack In Any Side Window (Cockpit or Cabin)

The following limitations apply when continued flight is required with a cracked outer or inner ply in any side window. These limitations do not apply to minor compression-type chips (Clamshell) which may occur on the milled edge of cockpit side windows. Refer to the maintenance manual for the disposition of such chips.

- 1. Continued flight is limited to 25 flight hours.
- 2. Flights shall be conducted with the cabin depressurized. The following placard shall be installed in clear view of the pilot:

PRESSURIZED FLIGHT IS PROHIBITED DUE TO A CRACKED SIDE WINDOW. CONDUCT FLIGHT WITH THE CABIN PRESSURE SWITCH IN THE DUMP POSITION.

4.32 PLACARDS

The following placards shall be installed throughout the interior of the aircraft.

Figure 4-5. On Overhead Panel In Pilot's Compartment

OPERATING LIMITATIONS

THE MARKINGS AND PLACARDS INSTALLED IN THIS AIRPLANE CONTAIN OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE COMMUTER CATEGORY. OTHER OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THIS CATEGORY ARE CONTAINED IN THE AIRPLANE FLIGHT MANUAL. NO ACROBATIC MANEUVERS INCLUDING SPINS ARE APPROVED. THIS AIRPLANE APPROVED FOR VFR, IFR, DAY AND NIGHT OPERATION AND IN ICING CONDITIONS.

Figure 4-6. On Overhead Panel In Pilot's Compartment

WARNING

STALL WARNING IS INOPERATIVE WHEN MASTER SWITCH IS OFF.
STANDBY COMPASS IS ERRATIC WHEN WINDSHIELD ANTI-ICE AND/OR AIR CONDITIONER AND/OR HIGH VENT BLOWER AND/OR LANDING LIGHTS ARE ON.

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Figure 4-7. On Overhead Panel In Pilot's Compartment

MAXIMUM IAS KNOTS	
GR EXTENSION	182
GR RETRACT	164
GR EXTENDED	182
APPROACH FLAP	202
FULL DN FLAP	158
MANEUVERING	182
	UC12W000 2012-F035

Figure 4-8. On Pilot's Window Sill

TURN OFF STROBE LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT OR DURING FLIGHT THROUGH FOG OR CLOUDS STD POSITION LIGHTS TO BE TURNED ON FOR ALL NIGHT OPERATIONS

Figure 4-9. On Pilot's And Copilot's Window Sills

WARNING

DO NOT SMOKE WHILE OXYGEN IS IN USE WITH DILUTER - DEMAND CREW MASK FLOW STOPS WHEN BREATHING STOPS

UC12W000_2012-F037

Figure 4-10. On Curved Pedestal Adjacent To Power Levers



Figure 4-11. On Pedestal Near Cabin Pressurization Controller

WARNING DE-PRESSURIZE CABIN BEFORE LANDING

Figure 4-12. Below Right Circuit Breaker Panel

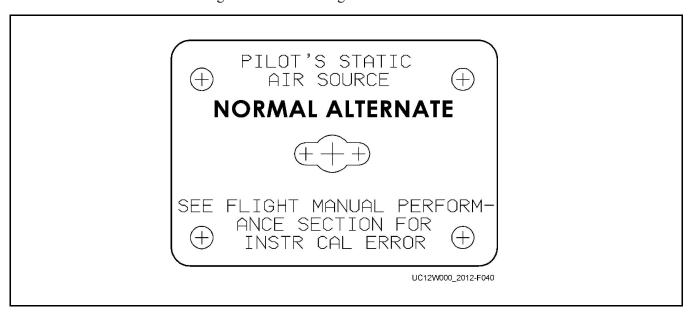


Figure 4-13. Below Latch On Forward Side Of Forward And Aft Partitions



Figure 4-14. On Cabin Side Of Forward And Aft Partitions And Aft Side Of Left Aft Partition

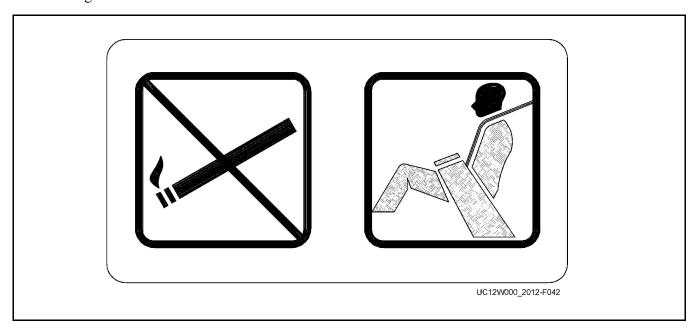


Figure 4-15. On Emergency Exit Handles

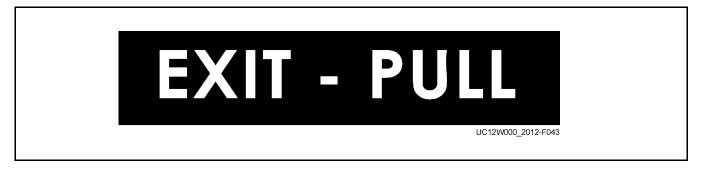


Figure 4-16. Below Emergency Handles On Exit Lock Lever (Visible Only When Lever Is In Locked Position)

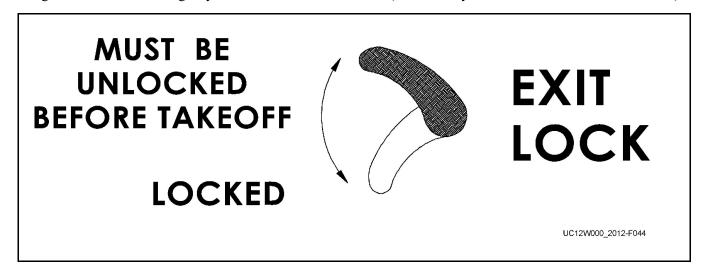


Figure 4-17. Outboard Of Each Passenger Chair

SEAT MUST BE LOCATED IN FULL OUTBD. POSITION FOR TAKEOFF AND LANDING.

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Figure 4-18. On Shoulder Harness Assy For All Chairs

SHOULDER HARNESS MUST BE WORN DURING TAKE-OFF AND LANDING WITH SEAT IN OUTBD POSITION. SEAT BACK UPRIGHT AND HEADREST FULLY EXTENDED

STOW BEFORE TAKEOFF AND LANDING

UC12W000_2012-F047

Figure 4-20. On Outside Surface Of First Aid Oxygen Access Door

FIRST AID OXYGEN — PULL

UC12W000_2012-F048

Figure 4-21. On Center Of Aft Bulkhead

COMPARTMENT CAPACITY 550 LBS

THIS INCLUDES BAGGAGE AND/OR EQUIPMENT AND/OR OPTIONAL FURNISHINGS

SEE WEIGHT AND BALANCE SECTION OF FLIGHT MANUAL INSTRUCTIONS

Figure 4-22. Center On Pull Handle Top Edge Of Escutcheon, Also Centered Between Coat Hooks In Vestibule



Figure 4-23. Airstair Door On Bottom Side Folding Step



Figure 4-24. Airstair Door Between Folding Steps

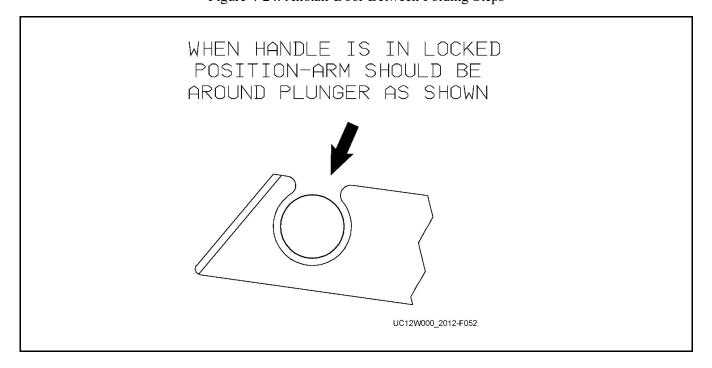


Figure 4-25. On Floor, Pilots Side Of Pedestal

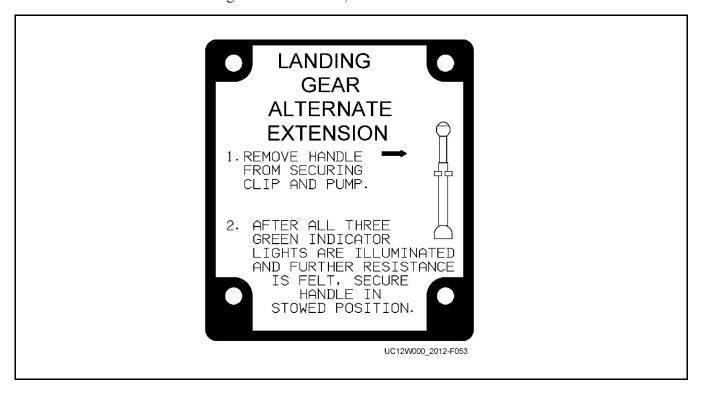


Figure 4-26. Aft Side Of Baggage Partition



Figure 4-27. Over Airstair Door

PRESS TO INSPECT DOOR LATCHES

Figure 4-28. Below Trim Controls On Pedestal

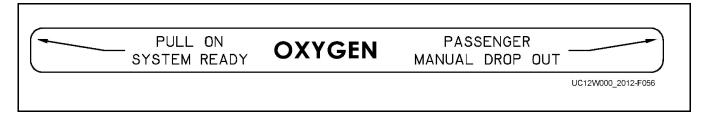


Figure 4-29. Inside Airstair Door Behind Handle

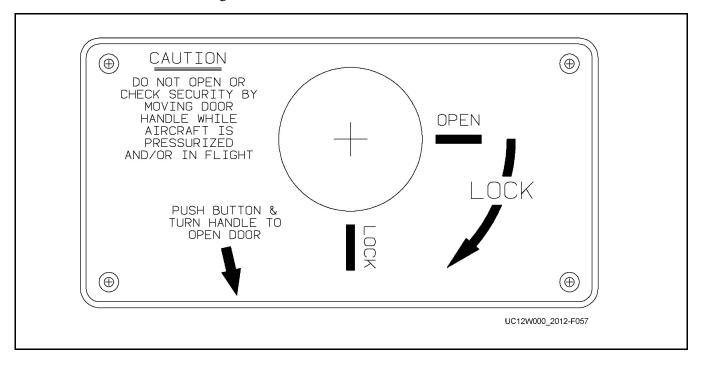


Figure 4-30. On Escutcheon Near Upper Access Cover Of Cargo Door

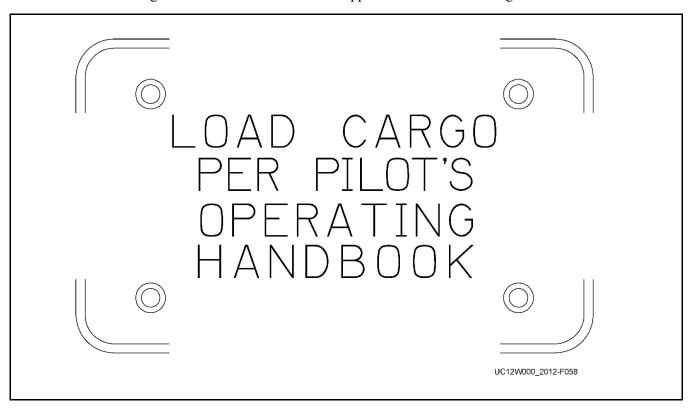


Figure 4-31. On Upper Access Cover Of Cargo Door

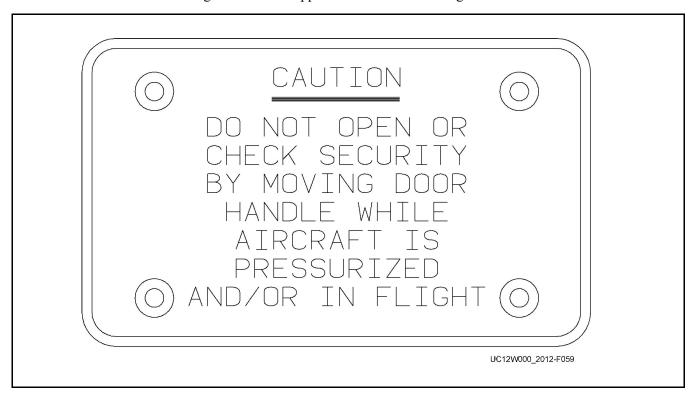


Figure 4-32. On Cargo Door Upper Latch Handle



Figure 4-33. On Lower Access Cover Of Cargo Door



Figure 4-34. On Inside Lower Access Cover Of Cargo Door

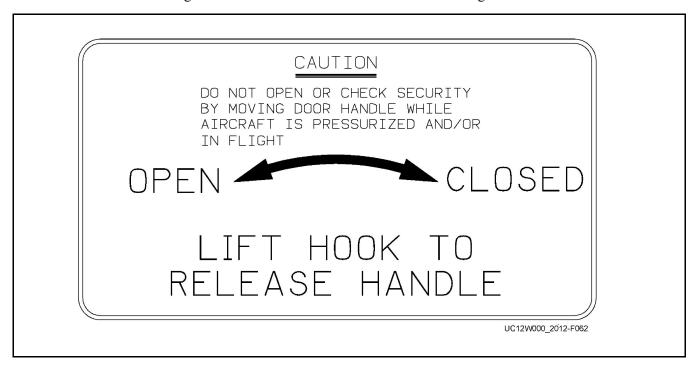
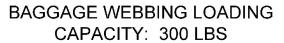


Figure 4-35. On Upper Access Cover Of Cargo Door



Figure 4-36. On "L-shaped" Baggage Webbing When Center Partition Is Not Installed In Baggage Compartment



UC12W000_2012-F064

Figure 4-37. Outboard Of Passenger Seat, Above Arm Rest And Below Window

SEAT BACK MUST BE IN UPRIGHT POSITION FOR TAXI, TAKEOFF, AND LANDING

Figure 4-38. Passenger Compartment Right Aft Partition, Upper Center



Figure 4-39. Outboard Of Forward Facing Passenger Chair, Above Arm Rest and Below Window

LIFE VEST STOWED IN SEAT BACK POCKET

UC12W000_2012-F068

Figure 4-40. On Avionics Rack Between Cooling Fan Openings

KEEP CLEAR

UC12W000_2012-F069

Figure 4-41. Passenger Compartment Above Life Raft

LIFE RAFT STOWAGE

Figure 4-42. Lower Drawer of Refreshment Bar

FWD PASSENGER AND CREW LIFE VESTS STORAGE

UC12W000_2012-F071

Figure 4-43. Above Outboard Arm Rest of Pilot, Copilot, and Passenger Chairs

LIFE VESTS STOWED IN LOWER DRAWER OF REFRESHMENT BAR

UC12W000_2012-F072

Figure 4-44. Passenger Compartment Left Aft Partition Above Radio Pouch

RADIO STORAGE ONLY MAX 3 LBS

Figure 4-45. Passenger Compartment, Left Forward Partition

OCCUPANT MUST FASTEN SEAT BELT DURING TAXI, TAKEOFF, AND LANDING

Figure 4-46. Aft Of Extended Range Fuel Tank

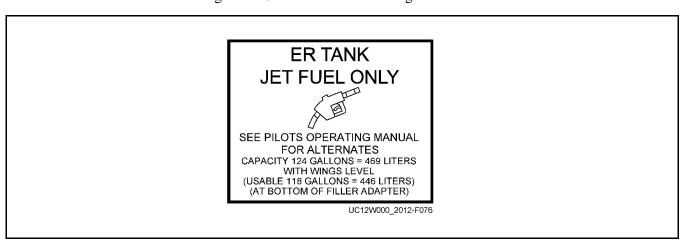


Figure 4-47. Aft Of Auxiliary Tank Cap



Figure 4-48. Aft Tip Of Extended Range Fuel Tank



4.33 KINDS OF OPERATIONS

The UC-12W is approved for the following types of operations when the required equipment, as shown in the KINDS OF OPERATIONS EQUIPMENT LIST, is installed and operable:

- 1. VFR Day.
- 2. VFR Night.
- 3. IFR Day.
- 4. IFR Night.
- 5. Icing Conditions.

4.34 KINDS OF OPERATIONS EQUIPMENT LIST

This airplane may be operated in day or night VFR, day or night IFR, and icing conditions when the required systems and equipment are installed and operable.

The following equipment list identifies the systems and equipment upon which type certification for each kind of operation was predicated. The systems and equipment listed shall be installed and operable for the particular kind of operation indicated.

The airplane is approved to be operated in accordance with a current Minimum Equipment List (MEL) approved by the FAA.

Numbers in the Kinds of Operations Equipment List refer to quantities required to be operative for the specified condition. The list does not include all equipment that may be required by specific operating rules. It also does not include components obviously required for the airplane to be airworthy, such as wings, empennage, engine, etc.

	VFF	DAY	,							
		VFR NIGHT								
SYSTEM and/or EQUIPMENT		IFR DAY								
					NIGH ⁻	Γ				
					ICE (CONDITIONS				
						REMARKS and/or				
						EXCEPTIONS				
AIRCRAFT SURVIVABILITY EQUIPMENT										
ASE Optical Sensors	4	4	4	4	4					
ASE Dispensers	2	2	2	2	2					
COMMUNICATIONS										
Static Discharge Wick	22*	22*	22*	22*	22*	* One wick per surface may				
SI SOTDIONI DOMED						be damaged or missing.				
ELECTRICAL POWER		,			_					
Battery	1	1	1	1	1					
Standby Battery (ESIS)	1	1	1	1	1					
BAT TIE OPEN Annunciator	1	1	1	1	1					
DC Generator	2	2	2	2	2					
L & R DC GEN Annunciators	2	2	2	2	2					
DC Load Meter	2	2	2	2	2					
DC Voltmeter/Battery Ammeter and Select Switch	1	1	1	1	1					
GEN TIE OPEN Annunciator	2	2	2	2	2					
ENGINE INDICATIONS										
Multifunctional Display (MFD)	1	1	1	1	1					
ENGINE OIL										
Chip Detector System Including L & R CHIP DETECT Annunciators	2	2	2	2	2					
Oil Pressure Indicator in MFD	2	2	2	2	2					
Oil Temperature Indicator in MFD	2	2	2	2	2					
L & R OIL PRES LO Annunciator	2	2	2	2	2					
ENVIRONMENTAL										
BLEED FAIL Annunciator	2	2	2	2	2					
Bleed Air Shutoff Valve	2	2	2	2	2					
CABIN ALT HI Annunciator	2	2	2	2	2					
Cabin Rate of Climb Indicator	1	1	1	1	1					
Outflow Valve/Safety Valve	2	2	2	2	2					
Pressurization Controller	1	1	1	1	1					
Differential Pressure/Cabin Altitude Indicator	1	1	1	1	1					
DUCT OVERTEMP Annunciator	1	1	1	1	1					
CABIN DIFF HI Annunciator	1	1	1	1	1					
Cabin Altitude Aural Warning	1	1	1	1	1					

	VFF	R DA	Y						
		VFR NIGHT							
SYSTEM and/or EQUIPMENT			IFR DAY						
				IFR	IT				
					ICE	CONDITIONS			
						REMARKS and/or			
						EXCEPTIONS			
EQUIPMENT/FURNISHINGS									
Exit Sign Self-Illuminating	2	2	2	2	2				
Emergency Locator Transmitter	1	1	1	1	1				
Seat Belt	*	*	*	*	*	* One per occupied seat.			
Shoulder Harness for Crew Seat	2	2	2	2	2				
Cockpit Checklist	1	1	1	1	1				
First Aid Kit	1	1	1	1	1				
Passenger Briefing Card	*	*	*	*	*	* One per passenger seat (Required for 14 CFR Part			
						135 operation only).			
FIRE PROTECTION									
Engine Fire Detector System	2	2	2	2	2				
Engine Fire Extinguisher	2	2	2	2	2				
Portable Fire Extinguisher	2	2	2	2	2				
FLIGHT CONTROLS									
Flap Position Indicator	1	1	1	1	1				
Flap System	1	1	1	1	1				
Trim Tab Position Indicator (Rudder, Aileron, Elevator)	3	3	3	3	3				
Stall Warning System	1	1	1	1	1				
Yaw Damp	1	1	1	1	1				
Rudder Boost System Including Annunciator	1	1	1	1	1				
FLIGHT INSTRUMENTS									
Primary Flight Display (PFD)	2	2	2	2	2				
Magnetic Compass	1	1	1	1	1				
Electronic Standby Instrument System (ESIS)	1	1	1	1	1				
AHRS	2	2	2	2	2				
Air Data Computer (ADC)	2	2	2	2	2				
Outside Air Temperature	1	1	1	1	1				
Overspeed Aural Warning	1	1	1	1	1				
Clock	0	0	1	1	1				

	VFF	R DA	Y						
SYSTEM and/or EQUIPMENT		VFR NIGHT							
				IFR	НТ				
					ICE	CONDITIONS			
						REMARKS and/or			
						EXCEPTIONS			
FUEL									
Fuel Transfer System Including Annunciator	2	2	2	2	2				
Standby Electric Fuel Pump	2	2	2	2	2				
FUEL PRES LO Annunciator	2	2	2	2	2				
Fuel Quantity System and Annunciator	2	2	2	2	2				
Firewall Fuel Shutoff System and Annunciator	2	2	2	2	2				
Engine Driven Boost Pump	2	2	2	2	2				
Fuel Crossfeed System and Annunciator	1	1	1	1	1				
ICE AND RAIN PROTECTION									
Alternate Static Air System	1	1	1	1	1				
Engine Auto-Ignition System and Annunciators	2	2	2	2	2				
Engine Anti-Ice System and Annunciators	2	2	2	2	2				
Heated Fuel Vent	0	0	2	2	2				
Heated Windshield	0	0	2	2	2				
Pitot Heat System and Annunciators	0	0	2	2	2				
Pneumatic Pressure Indicator	0	0	1	1	1				
Stall Warning Heat (Lift Transducer and Mounting Plate)	0	0	0	0	1				
Surface Deicer System	0	0	0	0	1				
WING DEICE Annunciator	0	0	0	0	1				
TAIL DEICE Annunciator	0	0	0	0	1				
Propeller Deicer System	0	0	0	0	1				
Wing Ice Light	0	0	0	0	2				
LANDING GEAR									
Landing Gear Position Indicator Light	3	3	3	3	3				
Landing Gear Handle Light	1	1	1	1	1				
Landing Gear Aural Warning	1	1	1	1	1				
Landing Gear Hydraulic Power Pack	1	1	1	1	1				
HYD FLUID LOW Annunciator	1	1	1	1	1				
Emergency Extension Hand Pump	1	1	1	1	1				

	VFF	R DA	Y					
		VFR NIGHT						
SYSTEM and/or EQUIPMENT			IFR					
				IFR	-IT			
					ICE	CONDITIONS		
						REMARKS and/or		
						EXCEPTIONS		
LIGHTS								
Cockpit and Instrument Lighting System	0	1	0	1	0			
DOOR UNLOCK Annunciator	1	1	1	1	1			
Landing Lights	0	2	0	2	0			
Position Lights	0	5	0	5	0			
Anticollision Lights	0	2	0	2	0			
Passenger Notice System (NO SMK FSB)	1	1	1	1	1			
Self-Illuminating Emergency Exit Signs	2	2	2	2	2			
Caution Flasher Annunciators	2	2	2	2	2			
Warning Flasher Annunciators	2	2	2	2	2			
MISCELLANEOUS EQUIPMENT (Single Pilot Operation Only)								
Headset	1	1	1	1	1			
Boom-Mounted Microphone	1	1	1	1	1			
Emergency, Abnormal, and Normal Procedures Checklist	1	1	1	1	1			
Kit 130-5015	0	0	2	2	2			
OXYGEN								
Oxygen System Including Indicator	1	1	1	1	1			
Oxygen Pressure Gage (Cockpit)	1	1	1	1	1			
OXY NOT ARMED Annunciator	1	1	1	1	1			
PASS OXYGEN ON Annunciator	1	1	1	1	1			
PROPELLER								
Autofeather System and Annunciators	1	1	1	1	1			
Propeller Reversing System and Annunciators	2	2	2	2	2			
Propeller Governor Test Switch	1	1	1	1	1			
Propeller Overspeed Governor	2	2	2	2	2			
Propeller Electric Ground Idle Stop	2	2	2	2	2			
Landing Gear Hydraulic Power Pack	1	1	1	1	1			
VACUUM SYSTEM								
Vacuum Gage	1	1	1	1	1			

PART II

Indoctrination

Chapter 5 — Indoctrination

CHAPTER 5

Indoctrination

5.1 INTRODUCTION

The information set forth here is intended as a guide to aircraft indoctrination. The requirements are considered the minimum and in no way intended to compromise any operational or training standards.

5.2 GROUND TRAINING PRIOR TO BEGINNING ON AIRCRAFT TRAINING

The UC-12W (Hawker Beechcraft King Air 350) is a Commercial-off-the-shelf (COTS) aircraft and as such most of the ground training is conducted through commercial FAA approved training facilities. The type pilot training at these facilities include: Initial and Recurrent International Procedures training and Flight Management Systems (FMS) training. Transport Aircrews (TA) ground training should be conducted at the unit.

5.2.1 NATOPS Manual Examination

Open and closed book NATOPS examinations stressing normal procedures, emergency procedures, aircraft systems and limitations are required to be completed prior to the NATOPS evaluation flight (aircraft or simulator).

5.3 FLIGHT TRAINING

Prior to beginning the flight training syllabus, all pilots/Naval Flight Officer (NFO)-Qualified Observers (QO) shall complete a CNO approved Command Aircraft Crew Training (CACT) course at a designated contractor facility.

Prior to beginning the flight training syllabus, all Transport Aircrewmen (TA) shall complete the designated ground school curriculum as set forth in current Training and Readiness (T&R) manual.

All flight crews shall have a current medical clearance, shall complete aviation physiological training set forth in current CNAF M-3710.7 prior to beginning aircraft training. An instructor pilot (IP) shall occupy a pilot seat for all pilot/NFO-QO/TA syllabus training.

5.4 PILOT QUALIFICATION

The Transport Plane Commander (TPC) and Transport Second Pilot (T2P) pilot qualification will be in accordance with CNAF M-3710.7 with the following exceptions:

5.4.1 Minimum Experience Requirements

Figure 5-1 contains the minimum experience requirements for each qualification.

5.5 CURRENCY REQUIREMENTS

Currency shall be in accordance with CNAF M-3710.7 for all semi-annual and annual minimum flying hour requirements and with applicable local directives.

5.5.1 Refresher Requirements

The minimum refresher requirements listed below may be increased at the unit commander's discretion commensurate with individual pilot proficiency.

5-1

5.6 FLIGHTCREW REQUIREMENTS

A TPC, T2P, and TA shall be required for all passenger and cargo missions. NFO-QOs may seek waiver of this requirement through COMMARFORPAC, COMMARFORCOM, or COMMARFORRES as appropriate. At Commanding Officer discretion, an (IP) and pilot/NFO-QO under instruction may fly cargo missions.

Note

The requirement for a TA may be waived by the Commanding Officer. This authority may be delegated.

5.7 PERSONAL FLYING EQUIPMENT REQUIREMENTS

Personal flying equipment requirements delineated in CNAF M-3710.7 for class aircraft shall be adhered to on each flight. Voice-capable survival radios are not required to be carried by individual crewmembers.

5.8 ANNUAL NATOPS TRAINING

Figure 5-3 summarizes the annual NATOPS training requirements.

5.8.1 Simulator Training

Commanding Officers/OICs may waive the requirement to attend CACT Recurrent for pilot's/NFO-QOs within six months of rotation date or if the pilot/NFO-QO will be deployed during recurrent training window. However, in no case will the waiver continue beyond 18 months since the previous CACT event (whether Initial or Recurrent). During the waiver period, the pilot/NFO-QO will retain his/her current qualifications.

	TPC	T2P	TA	NFO-QO
TOTAL PILOT HOURS	700	Note 3	N/A	N/A
TOTAL FIXED WING	200	100	N/A	Note 6
HOURS IN MODEL (NOTES 2 & 4)	100	Note 5	12	12
GROUND TRAINING SYLLABUS	Х	Х	Х	Х
FLIGHT TRAINING SYLLABUS	Х	Х	Х	Х
NATOPS EVALUATION	Х	Х	Х	Х

Figure 5-1. Minimum Experience Requirements

NOTES:

- 1. X denotes required item.
- 2. Cognizant type commanders (Commanding Officers for TA) may waive, in writing minimum flight and/or training requirements when experience and proficiency so warrant in accordance with CNAF M-3710.7.
- 3. Designated Naval Aviator. No minimum total pilot hour requirement.
- 4. Simulated hours may not be used for hours in model requirements.
- 5. No minimum number of hours required to attain T2P designation. However, pilot must complete 2000 series events and successfully complete all requirements for and pass both an instrument and NATOPS check flight.
- Designated NFO. No minimum number of hours required to attain QO designation. However, NFOs must complete 2000 series events and successfully complete all requirements for and pass both an instrument and NATOPS check flight.

Figure 5-2. Pilot Monthly Currency Requirements

QUAL	PERIOD	CURRENCY	REQUIREMENT	NOTE
TPC	90 Day (rolling)	Current		1
	91-180 Days	T2P	1 Flight w/TPC	2
T2P	180 Days (rolling)	Current		
	181-365 Days	Delinquent	2 Flights w/IP	3
NFO-QO	180 Days (rolling)	Current		
	181-365 Days	Delinquent	1 Flight w/IP	2
TA	180 Day (rolling)	Current		
	181-365 Days	Delinquent	1 Flight w/TA	
ALL	365+ Days	Delinquent		4

NOTES:

- 1. TPCs may not carry passengers unless he/she has made at least three takeoffs and landings within the preceding 90 days, and:
 - a. First Pilot Time must be logged.
 - b. Required takeoffs and landings were performed in the same type/model/series aircraft.
 - c. Takeoffs and landings may be accomplished in an FAA approved flight simulator (i.e., CACT).
- 2. Refresher flights may be conducted on either a proficiency flight or operational mission.
- 3. Refresher flights shall include a minimum: three landings, two instrument approaches, and SSE maneuvers.
- 4. CACT Recurrent and NATOPS evaluation required. (CACT does not apply to TAs.)

Completion of CACT Recurrent or NATOPS Evaluation satisfies refresher requirements for 90-180 and 181-365 day delinquencies.

Figure 5-3. Annual NATOPS Training Requirements

	TPC	T2P	TA	NFO-QO
FLIGHT OR SIMULATOR EVALUATION	Х	Х	Х	Х
OPEN BOOK	Х	Х	Х	Х
CLOSED BOOK	Х	Х	Х	Х
ORAL EXAM	Х	Х	Х	Х

PART III

Normal Procedures

Chapter 6 — Flight Preparation

Chapter 7 — Shore-Based Procedures

Chapter 8 — Overwater Operations

Chapter 9 — Functional Checkflight Procedures

CHAPTER 6

Flight Preparation

6.1 GENERAL

These procedures are designed to aid the operating crew in the conduct of an efficient and orderly flight.

6.2 CREW SCHEDULING PROCEDURE

6.2.1 Crew Day

Crew day begins when a crew reports to a designated place of duty to begin preparation for a mission or other military duties prior to commencing flight duties. Deadhead time and/or passenger time immediately prior to commencing duties as a crew member will count as crew day. Crew day terminates when the engines are secured at the end of a mission or series of missions. Maximum crew day is 14 hours with a functioning autopilot and 12 hours without a functioning autopilot.

6.2.2 Crew Rest

Crews will normally be scheduled for 12 hours of crew rest between missions. Crew rest begins when the aircraft is secured and flight related administration duties are complete. The normal 12 hour crew rest allows for crews to secure meals and an opportunity for eight hours uninterrupted sleep. For continuing missions or RONs away from home base a reduced crew rest period may be used at the aircraft commander's discretion, provided meals and an opportunity for eight hours uninterrupted sleep are available prior to the next days first takeoff. Aircraft commander's will delay missions to take rest whenever this action is in the interest of safety of flight.

6.3 MISSION PLANNING

Mission planning is the responsibility of the TPC and will cover all matters pertinent to the mission to be flown. Every task that can be completed prior to takeoff will contribute to the ease and success with which the actual flight is conducted.

6.3.1 Weather

A complete weather briefing and an understanding of the weather picture are prerequisites for successful mission planning. Enroute weather will dictate the probable altitude assignments and whether those altitudes assigned will be acceptable. Destination weather will determine expected delays in letdown and landing procedures and whether an alternate is required. This entire weather picture affects fuel planning and flight procedures.

6.3.2 Fuel Planning

A fuel-planning log should be prepared and cross-checked with actual fuel consumption on every flight. Fuel requirements are based on FAR Part 91 and depend on weather at desired destination. For fuel planning guidance when conducting over water operations refer to Chapter 8. OPARS should be used to the maximum extent possible.

6.3.2.1 Fuel Planning Definitions

6.3.2.1.1 Destination Fuel

Destination fuel is the fuel required to fly from point of origin to destination. Destination fuel includes fuel required for start, taxi, and flight to destination and should factor in delays expected enroute. OPARS refers to destination fuel as point of arrival (POA) fuel.

6.3.2.1.2 Alternate Fuel

Alternate fuel is the fuel required to fly from the initial approach fix (IAF) at destination to alternate airport at 10,000 feet then land.

6.3.2.1.3 Reserve Fuel

Reserve fuel is additional fuel taken on at departure point for unforeseen enroute contingencies. It is the fuel which can be burned enroute in addition to the planned burnoff and still have the required alternate fuel, if alternate fuel is required. Minimum required fuel is mandated as follows:

Destination Forecast ETA \pm 1 hour > 3000 – 3: Fuel required to fly at least 30 minutes (day) 45 minutes (night) at normal cruising speed (FAR 91.151).

Destination Forecast ETA \pm 1 hour \leq 3000 - 3: Fuel required to fly at least 45 minutes at normal cruising speed (FAR 91.167).

Use 175 KIAS at 10,000 feet when calculating reserve fuel.

Refer to Chapter 8 for reserve fuel requirements for over water operations.

Note

Reserve fuel may not be used for training.

6.3.2.1.4 Holding Fuel

Holding fuel is specific to over water operations. Holding fuel does not include fuel for anticipated ATC holding, approach procedures, or alternate requirements at departure or destination airports. Refer to Chapter 8 for holding fuel requirements for over water operations.

Note

Holding fuel may not be used for training.

6.3.2.1.5 General Fuel Planning

After consideration of the destination weather, one of the following formulas shall apply in calculating minimum fuel requirements.

6.3.2.1.6 Flights Conducted When Destination Forecast ETA ± 1 hour > 3000 - 3

Fuel to destination:

30 minutes of fuel at 175 KIAS at 10,000 feet (day) OR

45 minutes of fuel at 175 KIAS at 10,000 feet (night)

WARNING

- When L FUEL QTY or R FUEL QTY light illuminates, less than 30 minutes of fuel remains at maximum continuous power for that side.
- Zero fuel remains upon exhaustion of planned destination, alternate and reserve fuel.

6.3.2.1.7 Summary of Fuel Planning Requirements

Refer to Figure 6-1.

Figure 6-1. Summary of Fuel Planning Requirements

FUEL DESCRIPTION	DEST WX ETA ± 1 HR > 3000 – 3	DEST WX ETA ± 1 HR < 3000 – 3
A. Destination Fuel	Note 1	Note 1
B. Alternate Fuel	N/A	Note 2
C. Reserve Fuel	Day: Note 3 Night: Note 4	Note 4
D. Holding Fuel	N/A	N/A
E. Minimum Fuel Required	A + C	A + B + C

NOTES:

- 1. Fuel required to fly to destination airport. Includes start, taxi, and enroute fuel. When calculating with OPARS, includes appropriate fuel biases for departure, approach and in flight icing.
- 2. Fuel required to fly from destination IAF to the alternate airport at 10,000 feet.
- 3. Fuel required to fly for at least 30 minutes at 175 KIAS and 10,000 feet.
- 4. Fuel required to fly for at least 45 minutes at 175 KIAS and 10,000 feet.

6.3.3 Planning/Performance Data

Data and information required for determining the operational parameters and the mission requirements are found in A1-C12WA-NFM-200, Performance Data Supplement.

6.3.4 Weight and Balance

For loading information and weight and balance, refer to Chapter 23.

6.4 BRIEFING

The success of a flight is a direct measure of the preflight preparation, planning, and briefing. The briefing should include but is not limited to the following guidelines:

6.4.1 Administration

- 1. Aircrew.
 - a. Crew Rest/Crew Day.
 - b. Currency/Read and Initial.
- 2. Fuel Card/ Mission Pack.
- 3. Orders and Billeting.
- 4. Customs/Immigration.

6.4.2 Mission

- 1. Primary/Alternate.
- 2. Aircraft Assignment/Call sign.
- 3. Mission Timeline.

6.4.3 Crew Resource Management

- 1. PF/PNF/TA Duties and Responsibilities.
- 2. VIP Greeting, Loading, and Briefing.

3. Positive Change of Aircraft Control.

6.4.4 Fuel Planning

- 1. Initial Fuel Load.
- 2. Enroute Fuel Requirements and Management/OPARS Review.
 - a. Minimum Fuel (As per FARs, 37010.7, NATOPS).
 - b. Emergency Fuel.
- 3. Enroute fuel stop/FBO Review (contract fuel, location, etc.).
- 4. Gross Weight/Weight and Balance.

6.4.5 Weather

- 1. Departure.
- 2. Enroute.
- 3. Destination (± 1 hour of ETA).
- 4. Alternate (if required).

6.4.6 Communication and Nav Aids

- 1. Radios.
- 2. Navigation plan.
- 3. Duties and responsibilities.

6.4.7 Airport Data

- 1. NOTAMS/PPRs.
- 2. Elevation, runway length, width and arresting gear.
- 3. Approaches and lighting.
- 4. Passenger pick-up/drop-off location.

6.4.8 Departure and Climb Out

- 1. Performance planning.
- 2. Climb out procedures/restrictions.
- 3. Standard Instrument Departure (SID), review (if required).
- 4. Look out doctrine.

6.4.9 Route Review

- 1. Route of flight.
- 2. Diverts/Alternates enroute.

6.4.10 Arrival and Approach

- 1. Standard Arrival (STAR) review.
- 2. Type recovery (visual/instrument).

3. Primary, Alternate Approaches available.

6.4.11 Emergencies

- 1. Procedures/Responsibilities.
- 2. Ground Emergencies.
- 3. Abort Criteria/Procedures.
- 4. Airborne Emergencies.
- 5. System Failures.
- 6. NORDO procedures.

6.4.12 Operational Risk Management

- 1. What are the risks of this mission/flight?
- 2. Can we eliminate or reduce some of the risks?
- 3. Does this mission require command attention?
- 4. Operational Risk Management (ORM) sheet completed (if required).

6.5 NATOPS NORMAL PROCEDURES CARD CHECKLIST

The UC-12W aircraft Normal Procedures Checklist is shown in Figure 6-2. Detailed explanations of the numbered steps can be found in Chapter 7.

Figure 6-2. UC-12W NATOPS Checklist — Normal Procedures (Sheet 1 of 4)

		CABIN/COCKPIT PREFLIGHT		17.	FUEL QUANTITY CHECKED (LS
	1.	EMERGENCY EXITS AND SIGNS CHECKED		18.	DOORS/CABINLOCKED/CHECKED (RS/TA
#		AVIONICS RACK CHECKED			PASSENGER BRIEF COMPLET
#		CONTROL LOCKS REMOVED	_		TAGOLINOLIN BINLE TITLE OF THE LET
π		PARKING BRAKE SET			ENGINE STARTING
,,		ELT ARM		1.	GEN TIES (NIGHT OPS) MAN CLOSE (LS
#		FUEL PANEL CHECKED			PROP AREA CLEAR (BOTH
					ENGINES START (LS
#		BATTERY BUS			CONDITION LEVERS LOW IDLE (LS
		VOLTMETER BAT (≥23V), OTHERS (0V)			L AND R PROP RPM 1,050 MIN (LS
#		BATTERY ON			
#	10.	VOLTMETER TPL (≥22V), GENS (0V), CTR (≥23V), EXT PWR (0V)			[L PROP PITCH] AND [R PROP PITCH] ILLUMINATED (LS
#	11.	GEN TIES MAN CLOSE		7.	VOLTAGE AND
#	12.	VOLTMETER GENS (≥23V)			GENERATORS CHECKED AND RESET (LS
#		FUEL QUANTITY/SYSTEM CHECKED			BEFORE TAXI
#		LANDING GEAR HANDLE AND CB DOWN/IN		4	
#		CONDITION LEVERS FUEL CUTOFF	#		ELECTRICAL SYSTEM CHECKED (LS
#		TRIM			AVIONICS MASTER ON (LS
		COCKPIT VOICE			MSN PWR ON (RS
#	17.	RECORDER TEST AND ERASE			MISSION EQUIPMENT AS REQ (RS
11	10	BATTERY OFF			FURNISHINGS AS REQ (RS
#		OXYGEN SYSTEM CHECKED AND SET			FSB ON (RS ENVIRONMENTALS SET (RS
				8.	FMS CHECKED AND SET (BOTH
		BEFORE START	#	9.	FLAPS CHECKED AND SET (BOTH
	1.	SEATS AND	#	10.	ICE PROTECTION EQUIP CHECKED (LS
		RUDDER PEDALS ADJUSTED (BOTH)	#	11.	ENGINE ANTI-ICE CHECKED AND ON (LS
	2.	SEATBELTS AND		12.	ESIS
		HARNESSES FASTENED (BOTH)			DISPLAY INITIALIZATION COMPLETE (RS
		PARKING BRAKE SET (LS)			OVERSPEED WARNING TESTED (RS
	4.	CHOCKS REMOVED (LS)		14.	PROP SYNC O
	5.	INSTRUMENT AND			TCAS II TESTED TA/RA AND ABV (RS
		SUBPANELS CHECKED (BOTH)			IFF CHECKED AND SET (AS REQ) (RS
#	6.	REVERSIONARY			EMER FREQ EXTINGUISHED (RS
	_	SWITCH PANEL CHECKED (RS)	#	18.	VACUUM AND
	7.	POWER CONSOLE			DEICE PRESSURE CHECKED (RS
	_	AND PEDESTAL			PRESSURIZATION CHECKED AND SET (RS
#		LDG GEAR ALT EXT HANDLE STOWED (LS)			TAWS+ TESTED (LS
		ELECTRIC HEAT AS REQ WITH GPU			FLIGHT AND ENGINE INST CHECKED (BOTH
		CIRCUIT BREAKERS CHECKED (BOTH)		22.	AVIONICS AND RADAR CHECKED AND SET (RS
#	11.	PILOTS STATIC AIR SOURCE NORMAL (RS)	ш	23	AUTOPILOT AND
	12.	BATTERY ON (LS)	#	25.	YAW DAMP
	13.	ANNUNCIATORS CHECKED (RS)		24.	ELECTRIC PITCH TRIM CHECKED (BOTH
	14.	ENGINE WARNING TONES			FLIGHT
		SYSTEM TEST CHECKED (LS)		_0.	CONTROLS FREE AND CORRECT (LS
	15.	PILOT'S SUBPANEL CHECKED (LS)		26.	V SPEEDS SET (LS
#	16.	COPILOT'S SUBPANEL CHECKED (RS)			TAKEOFF BRIEF COMPLETE (LS
		Items marked with a "#" may be omitted at the			

Figure 6-2. UC-12W NATOPS Checklist — Normal Procedures (Sheet 2)

	TAXI	8.	BLEED AIR VAL	VES OPEN (RS
1. 1	LIGHTS AS REQ (LS)	9.	PRESSURIZATION	ON CHECKED (PNF/TA
2. 1	BRAKES CHECKED (BOTH)	10.	FUEL TRANSFE	R CHECKED (PF
	FLIGHT INSTRUMENTS CHECKED (BOTH)			CELLES CHECKED (BOTH
	ENGINE RUNUP		CLIME	B TRANSITION
	RUDDER BOOST	1.	ALTIMETERS	STD SET, CROSS CHKD (BOTH
	SWITCH CHECKED AND ON (RS) OVERSPEED GOV AND			OFF (PNF
	RUD BOOST			
	LOW PITCH STOPS AND			CRUISE
	PRIM GOV CHECKED (LS)	1.	PROPS	1,500 OR AS DESIRED (PF
	AUTOFEATHER AND	2.	CRUISE POWER	R SET (PF
	AUTO-IGNITION CHECKED (LS)	3.	AUTOFEATHER	OFF (LS
	AUTOFEATHER ARM (LS)	4.	ECS MODE	AS DESIRED (PNF
0. 1	MANUAL PROP FEATHER CHECKED (LS)			JMENTS MONITOR (BOTH
	BEFORE TAKEOFF			NORM/AS REQ (PNF
1. ;	STATIC TAKEOFF POWER CONFIRM (LS)			Y MONITOR (PF
	FUEL QTY, FLIGHT AND ENG INST CHECKED AND SET (LS)			AS REQ (PNF
	BLEED AIR VALVES SET (RS)			DESCENT
	ECS MODE, BLOWERS			
	AND TEMPS AS REQ (RS)			ON SET (PNF/TA
5.	GENERATOR LOAD CHECKED (RS)			BELOW/AS REQ (PNF
6. I	BATTERY AMMETER BELOW 10 AMPS (RS)	3.	WINDSHIELD AN	NTI-ICE AS REQ (PF
7.	PROP LEVERS FULL FORWARD (LS)	4.	BRAKE DEICE .	AS REQ (PF
8.	TRIM0/0/2 UP (LS)	5.	WINDOW DEFO	G AS REQ (PF
9. 1	FLAPS SET (RS)	6.	CABIN EQUIPME	ENTPOSITIONED (PNF/TA
	LINEUP		DESCE	NT TRANSITION
1.	EXTERIOR LIGHTS SET (LS)	1.	ALTIMETERS	SET, CROSS CHKD (BOTH
2.	ENGINE ANTI-ICE AS REQ (LS)	2.	RECOG LIGHTS	5 ON (PF
3.	ICE PROTECTION SET (LS)			
4.	TRANSPONDER/IFF ATC OR TA/RA			PPROACH
	(AS REQ) (RS)	1.	ALTIMETERS	SET, CROSS CHKD (BOTH
	RADAR AS REQ (RS)	2.	VREF AND MINII	MUMS SET (PNF
	ALE-47 ARM (AS REQ) (RS/TA)	3.	AVIONICS/RADA	AR/FLT INST CHECKED AN
	AUTO-IGNITION ARMED (LS)			SET (BOTH
	HEADING SET (RS)	4.	APPROACH BRI	IEF COMPLETE (PF
9. /	ANNUNCIATORS CONSIDERED (RS)	5.	AUTOFEATHER	ARMED (LS
	CLIMB	6.	ENVIR BLEED A	IR LOW (PNF
	LANDING GEAR AND LIGHTS UP AND OFF (PF)			ON (PNF
	FLAPS UP (PNF)			SET (PNF
	ENGINE INSTRUMENTS MONITOR (PNF)	9.	FLAPS	APPROACH (PNF
	YAW DAMP ENGAGED (PNF)		Voce -	— FLAPS DOWN
	` '	≤ 15,6		107
	PROPS 1,600 OR AS DESIRED (PF)	≤ 15,0 ≤ 15,0		107
	CLIMB POWER SET			
7. \	WINDSHIELD ANTI-ICE/DEFOG AS REQ (PF)	≤ 14,0	700	104

Figure 6-2. UC-12W NATOPS Checklist — Normal Procedures (Sheet 3)

21. INST EMER LIGHTS OFF (RS	LANDING GEAR HANDLE DOWN, THREE GREEN (PF)
22. TIEDOWNS AND CHOCKS INSTALLEI	EXT LTS MODE SW AS REQUIRED
	PROP SYNC ON (PF)
	PROPS 1,700 RPM (PF)
GPU START	SURFACE DEICE AS REQUIRED (PF)
1. BATTERY VERIFY ON (LS)	FLAPS DOWN (PNF)
2. GEN TIES (NIGHT OPS) MAN CLOSE (LS)	YAW DAMP OFF (PF)
, , ,	AFTER LANDING
3. VOLTMETER BAT (20 VOLTS MIN) (RS)	ALE-47 SAFE (AS REQ) (RS/TA)
4. EXTERNAL POWER OFF (LS)	ENGINE AUTO-IGNITION OFF (LS)
5. AVIONICS MASTER OFF (LS)	ENGINE ANTI-ICE ON (LS) EXTERIOR AND
6. LEFT AND RIGHT GENS OFF (LS)	INTERIOR LIGHTS AS REQ (LS)
7 DATTEDVILLE NORM (LC)	ICE PROTECTION OFF (LS)
7. BATTERY BUS NORM (LS	IFF MODE 4
8. BEACON ON (LS	CODE SWITCH HOLD (AS REQ) (RS) TRANSPONDER/IFF STBY (AS REQ) (RS)
9. EXTERNAL POWER SOURCE ON (LS	RADAR
10. VOLTMETER EXT PWF	TRIM 0/0/2 UP (RS)
(28.0 TO 28.4 VOLTS) (RS	FLAPS UP (RS)
11. EXTERNAL POWER ON [EXT PWR] —	PRESSURIZATION DIFFERENTIAL . ZERO (RS)
ILLUMINATED (LS)	BLEED AIR VALVES ENVIR OFF (RS)
12. PROP LEVERS FEATHER (LS)	SHUTDOWN AND SECURING
13. PROP AREA CLEAR (BOTH	PARKING BRAKE SET (LS)
·	AVIONICS MASTER OFF (LS)
14. ENGINES START	MISSION EQUIPMENT
15. EXTERNAL POWER OFF (LS	ESIS POWER OFF (LS)
16. EXTERNAL POWER SOURCE TURN OFF	AUTOFEATHER OFF (LS)
DISCONNECT FROM	ECS MODE OFF (RS)
AIRPLANE; SECURE DOOF	COCKPIT/CABIN BLOWER AUTO (RS)
17. [EXT PWR] EXTINGUISHED (RS)	OXYGEN CONTROLS PUSH OFF (LS)
18. RIGHT GEN RESET, THEN ON	BATTERY CHARGED (RS)
	BRAKE DEICE ON, THEN OFF AS REQ (LS)
19. VOLTMETER L GEN (LS	ITT STABILIZED ONE MINUTE (LS)
20. LEFT GEN RESET, THEN ON (LS	INST EMER LIGHTS AS DESIRED (RS)
21. RIGHT GEN RESET, THEN ON (LS	CONDITION LEVERS FUEL CUTOFF (LS) PROP LEVERS FEATHER (LS)
22. PROP LEVERS FULL FORWARD (LS	OVERHEAD PANEL SWITCHES OFF (RS)
	EXTERIOR LIGHTS OFF (LS)
23. L AND R PROP RPM 1,050 MIN (LS)	CABIN ENTRY LIGHTS AS REQ (RS)
24. [L PROP PITCH] AND	BATT AND GEN SWITCHES
[R PROP PITCH] ILLUMINATED (LS	(BELOW 15% N ₁) OFF (LS)

Figure 6-2. UC-12W NATOPS Checklist — Normal Procedures (Sheet 4)

LEFT ENGINE RESTART (GROUND)	3. PARKING BRAKE SET (LS)
1. ECS MODE OFF (RS)	4. CHOCKS REMOVED (LS)
2. BLEED AIR VALVES ENVIR OFF (RS)	5. DOORS/CABINLOCKED/CHECKED (RS/TA)
3. LEFT PROPELLER FULL FORWARD (LS) 4. RIGHT CONDITION LEVER HIGH IDLE (LS) 5. PROP AREA CLEAR 6. LEFT ENGINE START (LS) 7. CONDITION LEVERS LOW IDLE (LS) 8. L AND R PROP RPM 1,050 MIN	6. POWER CONSOLE AND PEDESTAL
9. [L PROP PITCH] AND [R PROP PITCH] ILLUMINATED	11. FMS CHECKED AND SET (BOTH) 12. ENGINE ANTI-ICE ON (LS)
10. VOLTAGE AND GENERATORS CHECKED AND RESET BEFORE TAXI - POST PAX DROPOFF/PICKUP	13. PRESSURIZATION SET (RS) 14. AVIONICS AND RADAR CHECKED AND SET (RS)
This checklist combines applicable items from the BEFORE START, BEFORE TAXI, and ENGINE RUNUP checklists; it hall only be used between flight legs while at least one engine and systems remain powered on.	15. FLIGHT
 SEATS AND RUDDER PEDALS	18. MANUAL PROP FEATHER CHECKED (LS) 19. TAKEOFF BRIEF COMPLETE (LS) Resume normal checklist procedures from BEFORE TAKEOFF.

CHAPTER 7

Shore-Based Procedures

Note

- All airspeeds quoted in this section are indicated airspeeds (IAS) and assume zero instrument error.
- Closed [BRACKETS] in this section denote annunciator(s).

7.1 AIRSPEEDS FOR SAFE OPERATION (16,500 LBS (7,484 KG))

- 1. Maximum Demonstrated Crosswind Component 20 Knots.
- 2. Maximum Demonstrated Wind Components for Coupled Approaches.
 - a. Crosswind 32 Knots.
 - b. Tailwind 14 Knots.
- 3. Two-Engine Best-Angle-of-Climb (V_X) 135 Knots.
- 4. Two-Engine Best-Rate-of-Climb (V_Y) 135 Knots.
- 5. Cruise Climb (All Altitudes).

Sea Level to 35,000 feet — 135 Knots.

Note

Cruise Climb airspeed of 150 Knots is acceptable for passenger comfort in non-combat environments. To ensure obstacle clearance, terrain avoidance, and accurate performance chart usage, 135 Knots is required.

- 6. Maneuvering Speed (V_A) 182 Knots.
- 7. Turbulent Air Penetration 170 Knots.



For turbulent air penetration, use an airspeed of 170 knots. Avoid over-action on power levers. Turn off autopilot altitude hold. Keep wings level, maintain attitude and avoid use of trim. Do not chase airspeed and altitude. Penetration should be at an altitude which provides adequate maneuvering margins when severe turbulence is encountered.

- 8. Maximum Airspeed for Effective Windshield Anti-icing 226 Knots.
- 9. Intentional One-Engine-Inoperative Speed (V_{SSE}) 135 Knots.
- 10. Air Minimum Control Speed (V_{MCA}).
 - a. Flaps Up 101 Knots.
 - b. Flaps Approach 98 Knots.

7.2 PROCEDURES BY FLIGHT PHASE

7.2.1 Cabin/Cockpit Preflight

Note

Items marked with a "#" may be omitted at pilot's discretion after the first flight of each day.

- 1. Emergency exits and signs CHECKED.
 - a. Aft exit signs ON TEST, Check sign illumination, then OFF RESET.
 - b. Forward exit sign ON TEST, Check sign illumination, then OFF RESET.
 - c. Emergency exits SECURE AND UNLOCKED.
- #2. Avionics rack CHECKED.
 - a. Circuit breakers IN.
 - b. ALE-47 Weight on Wheels (WOW) Bypass switch OFF.
 - c. ALE-47 safety switch flag pin INSTALLED.
- #3. Control locks REMOVED.
- 4. Parking brake SET.
- #5. ELT switch ARM.
 - a. Check switch position and Yellow [XMT] Light EXTINGUISHED.
- 6. Fuel panel CHECKED.
 - a. Standby pumps OFF.
 - b. Crossfeed flow OFF.
 - c. Aux transfer override switches AUTO.
 - d. Circuit breakers IN.
- #7. Battery bus NORM.
- 8. Voltmeter:
 - a. BAT position 23 VOLTS MINIMUM.
 - b. All other positions 0 VOLTS.
- #9. Battery ON.



OVHD PED and SUBPANEL lights and MISSION POWER shall be verified off before applying aircraft battery power in order to prevent possible damage to electrical components.

#10. Voltmeter:

- a. TPL FED 22 VOLTS MINIMUM.
- b. R GEN and L GEN 0 VOLTS.
- c. CTR 23 VOLTS MINIMUM.

- d. EXT PWR 0 VOLTS.
- #11. GEN TIES MAN CLOSE.
- #12. Voltmeter R GEN AND L GEN 23 VOLTS MINIMUM.
- #13. Fuel quantity/system CHECKED.
 - a. Check MAIN and AUXILIARY and EXTENDED RANGE tank fuel levels.
 - b. Firewall fuel valves CLOSE Left and Right [EXTINGUISHER PUSH] and [CLOSED] ILLUMINATED.
 - c. Standby pumps ON [L FUEL PRES LO] and [R FUEL PRES LO] ILLUMINATED.
 - d. Firewall fuel valves OPEN Left and Right [EXTINGUISHER PUSH] and [CLOSED] EXTINGUISHED, [L FUEL PRES LO] and [R FUEL PRES LO] EXTINGUISHED.
 - e. Standby pumps OFF [L FUEL PRES LO] and [R FUEL PRES LO] ILLUMINATED.
 - f. Crossfeed ALTERNATELY LEFT AND RIGHT [FUEL CROSSFEED] ILLUMINATED, [L FUEL PRES LO] and [R FUEL PRES LO] EXTINGUISHED.
 - g. Crossfeed OFF.
 - h. Fuel quantity TEST [L FUEL QTY] and [R FUEL QTY] ILLUMINATED.
- #14. Landing gear handle and CB DOWN/IN.
 - a. Landing gear [L], [R], and [NOSE] ILLUMINATED.
 - b. Circuit breaker in.
- #15. Condition levers FUEL CUTOFF.
- #16. Trim controls 0/0/2 UP.
 - a. Rudder and aileron SET TO "0" UNITS.
 - b. Elevator SET TO "2" UNITS NOSE UP.

CAUTION

The elevator trim system must not be forced past the limits which are indicated by red lines on the elevator trim indicator scale.

- #17. Cockpit voice recorder panel TEST and ERASE.
- #18. Battery OFF.
- #19. Oxygen system preflight inspection CHECKED AND SET.
 - a. Passenger manual drop-out PUSH OFF.
 - b. System ready PULL ON.
 - c. Oxygen masks (Pilot and Copilot) CHECK.
 - (1) Select EMER position CHECK CONTINUOUS FLOW.
 - (2) Set 100%.
 - d. Oxygen duration DETERMINE.

7.2.2 Exterior Preflight

Note

After the first flight of the day, only those items of the Exterior Preflight Inspection that are marked with a "†*" need to be accomplished. (Fuel Tank Caps and Engine Oil Quantity/Filler Caps do not need checked unless those systems were serviced).

7.2.2.1 Left Wing and Nacelle

- 1. Cabin door seal, step extension cable, light wire, damper, and handrails CHECK.
- 2. Left side windows CHECK.
- 3. Flaps (condition, asymmetry protection, and flap tracks) CHECK.
- 4. Aileron and tab CHECK.
- 5. Static wicks (aileron and winglet) CHECK.
- 6. Siphon break vent CLEAR.
- 7. Lights CHECK.
- †♦8. Main fuel tank cap SECURE.
 - 9. Stall warning vane CHECK.
- †♦10. Tie-down REMOVE.
 - 11. Flush outboard fuel drain DRAIN.
 - 12. Outboard deice boot and stall strip CHECK.
 - 13. Wing panels SECURE.
 - 14. Leading-edge fuel tank and gravity-line drains DRAIN.
 - 15. Inverter cooling louvers CLEAR.
 - 16. Flush fuel vent and heated fuel vent CLEAR.
- †◆17. Landing gear (doors, tires, strut, and wheel well) CHECK.
 - 18. Engine oil vent CLEAR.
 - 19. Brake line and brake deice plumbing CHECK.
 - 20. Torque knee assembly and safety switch CHECK.
 - 21. Brakes CHECK.
 - 22. Fire extinguisher pressure CHECK, refer to Figure 7-1.

Figure 7-1. Fire Extinguisher vs Temperature

FIRE EXTINGUISHER PRESSURE VS TEMPERATURE									
°F	-40	-20	0	20	40	60	80	100	120
°C	-40	-29	-18	-7	4	16	27	38	49
PSI RANGE	190	220	250	290	340	390	455	525	605
	to								
	240	275	315	365	420	480	550	635	730

- †♦23. Chocks REMOVE.
 - 24. Fuel strainer and fuel filter drains DRAIN.
 - 25. Collector drain CLEAR.
 - 26. Ice vane and oil radiator exhaust CLEAR.
 - 27. Ice light CHECK.
- †♦28. Engine oil CHECK QUANTITY, CAP SECURE.
 - 29. Cowling air exhaust CLEAR.
 - 30. Engine cowling, doors, and panels (left side) SECURE.
 - 31. Exhaust stack and fairing (left side) CHECK FOR CRACKS.
 - 32. Top cowling camlocks (left side) SECURE.
- †◆33. Propeller CHECK and ROTATE.
 - 34. Forward air intakes on top cowling CLEAR.
 - 35. Engine and oil radiator air intakes CHECK.
 - 36. Top cowling camlocks (right side) SECURE.
 - 37. Exhaust stack and fairing (right side) CHECK FOR CRACKS.
 - 38. Swing check valve exhaust CLEAR.
 - 39. Generator air intake CLEAR.
 - 40. Engine cowling, doors, panels, and VGs (right side) SECURE.
 - 41. Nacelle wing locker latches (if installed) SECURE.
- †♦42. Auxiliary fuel tank cap SECURE.
- †♦43. Extended fuel tank cap SECURE.
 - 44. Hydraulic gear service door SECURE.
 - 45. Inboard deice boot CHECK.
 - 46. Heat exchanger air intake and exhaust CLEAR.
 - 47. Hydraulic gear overfill and vent lines CLEAR.
 - 48. Auxiliary fuel tank drain DRAIN.
 - 49. Extended fuel tank drain DRAIN.
 - 50. Lower antennas and panels SECURE.

7.2.2.2 Nose

- 1. OAT probe/relief tube vent CHECK.
- 2. Brake reservoir vent CLEAR.
- 3. Left avionics access panel SECURE.
- 4. Left ASE optical sensor fairings SECURE.
- 5. Left ASE optical sensor lens CLEAN.
- 6. Air conditioner condenser exhaust duct CLEAR.

- 7. Windshield and wipers CHECK.
- 8. Radome condition CHECK.
- †♦9. Pitot masts CLEAR.
- †♦10. Landing and taxi lights CHECK.
 - 11. Nose gear (shimmy damper, stop block, torque knee, strut, and tire) CHECK.
 - 12. Nose gear doors and wheel well CHECK.
 - 13. Air conditioner condenser intake duct CLEAR.
 - 14. Right avionics access panel SECURE.
 - 15. Right ASE optical sensor fairings SECURE.
 - 16. Right ASE optical sensor lens CLEAN.

7.2.2.3 Right Wing and Nacelle

- 1. Ejector exhaust CLEAR.
- 2. Auxiliary fuel tank drain DRAIN.
- 3. Extended fuel tank drain DRAIN.
- 4. Battery box drain CLEAR.
- 5. Lower panels SECURE.
- 6. Heat exchanger air intake and exhaust CLEAR.
- 7. Inboard deice boot CHECK.
- 8. Battery access panel SECURE.
- †♦9. Auxiliary fuel tank cap SECURE.
- †♦10. Extended fuel tank cap SECURE.
- †◆11. Engine oil CHECK QUANTITY, CAP SECURE.
 - 12. Cowling air exhaust CLEAR.
 - 13. Engine cowling, doors, and panels (left side) SECURE.
- †♦14. Nacelle wing locker latches (if installed) SECURE.
 - 15. Collector drain CLEAR.
 - 16. Exhaust stack and fairing (left side) CHECK FOR CRACKS.
 - 17. Top cowling camlocks (left side) SECURE.
- †◆18. Propeller CHECK and ROTATE.
 - 19. Forward air intakes on top cowling CLEAR.
 - 20. Engine and oil radiator air intakes CHECK.
 - 21. Top cowling camlocks (right side) SECURE.
 - 22. Exhaust stack and fairing (right side) CHECK FOR CRACKS.
 - 23. Swing check valve exhaust CLEAR.
 - 24. Generator air intake CLEAR.

- 25. Engine cowling, doors, and panels (right side) SECURE.
- 26. Ice light CHECK.
- 27. Oil radiator and ice vane exhaust CLEAR.
- 28. Fuel filter and fuel strainer drains DRAIN.
- †♦29. Landing gear (doors, tires, strut, and wheel well) CHECK.
 - 30. Fire extinguisher pressure CHECK.
 - 31. Engine oil vent CLEAR.
 - 32. Brake line and brake deice plumbing CHECK.
 - 33. Torque knee assembly and safety switch CHECK.
 - 34. Brakes CHECK.
- †♦35. Chocks REMOVE.
 - 36. Heated fuel vent and flush fuel vent CLEAR.
 - 37. Inverter cooling louvers CLEAR.
 - 38. Gravity-line and leading-edge fuel tank drains DRAIN.
 - 39. External power door SECURE.
 - 40. Outboard deice boot and stall strip CHECK.
- †♦41. Tie-down REMOVE.
 - 42. Flush outboard fuel drain DRAIN.
 - 43. Wing panels SECURE.
- †♦44. Main fuel tank cap SECURE.
 - 45. Lights CHECK.
 - 46. Static wicks (winglet and aileron) CHECK.
 - 47. Siphon break vent CHECK.
 - 48. Aileron CHECK.
 - 49. Flaps (condition, asymmetry protection, flap tracks, limit switches, and position transmitter) CHECK.
 - 50. Right side windows CHECK.

7.2.2.4 Right Aft Fuselage

- 1. Lower antennas and beacon CHECK.
- 2. Oxygen service access door SECURE.
- 3. Static ports CLEAR.
- 4. ELT antenna CHECK.
- 5. Aft compartment bottom access door SECURE.
- †♦6. Tie-down REMOVE.
 - 7. Ventral fin drain holes CLEAR.
 - 8. Cabin air exhaust CLEAR.

- 9. Access panel SECURE.
- 10. ASE optical sensor fairing SECURE.
- 11. ASE optical sensor lens CLEAN.
- 12. ASE dispenser fairings SECURE.

7.2.2.5 Tail

- 1. Ventral fin and static wick CHECK.
- 2. VOR antennas (right and left) CHECK.
- 3. Rudder, rudder tab, stinger and static wicks CHECK.
- 4. Horizontal stabilizer, boots, and static wicks (right and left) CHECK.
- 5. Elevator, tab, and static wicks CHECK.
- 6. Tabs in neutral position VERIFY.

Note

The elevator trim tab neutral position is determined by observing that the trailing edge of the elevator trim tab aligns with the trailing edge of the elevator when the elevator is resting against the downstops.

7. Position light, tail floodlights (left and right) — CHECK.

7.2.2.6 Left Aft Fuselage

- 1. Access panels SECURE.
- 2. Static ports CLEAR.
- 3. ASE optical sensor fairing SECURE.
- 4. ASE optical sensor lens CLEAN.
- 5. ASE dispenser fairings SECURE.
- 6. Oxygen overpressure discharge and aft compartment drain tubes CLEAR.
- 7. Relief tube CLEAR.

7.2.3 Before Start Checklist

Note

- Items marked with a "#" may be omitted at pilot's discretion after the first flight of each day.
- Power settings and performance shall be predicated on the OAT from the pilot's side console display and not from the temperature displayed on the pilot's PFD and MFD.
- 1. Pilot seats and rudder pedals ADJUSTED. (BOTH)
- 2. Seatbelts and shoulder harnesses FASTENED. (BOTH)
- 3. Parking brake CONFIRM SET. (LS)
- 4. Chocks REMOVED. (LS)
- 5. Pilot's and Copilot's instrument panel and subpanel CHECKED. (BOTH)

- a. ESIS power TEST (Green Light ILLUMINATED).
- b. ESIS power ON (Amber Light ILLUMINATED).
- c. Battery bus CONFIRM NORM.
- d. Engine anti-ice ON and MAIN.

CAUTION

To minimize ingestion of ground debris, the engine anti-ice system should be ON for all ground operations.

- e. Landing gear relay circuit breaker IN.
- f. Landing gear control DOWN.
- g. Pilot clock (control wheel) CHECK and SET.
- h. Window defog OFF.
- i. ECS mode OFF.
 - (1) Cockpit/Cabin blower AUTO.
 - (2) Envir bleed air REQUIRED.
- j. Copilot clock (control wheel) CHECK and SET.
- k. Master panel and cockpit lights As required.
- 1. Mic switches NORMAL.
- #6. Reversionary switch panel CHECKED. (RS)
 - a. DG FREE/NORM NORM.
 - b. Slew \pm , CENTER.
 - c. ATC select STBY for TDR-94 operations; IFF for APX-119 operations.
 - d. Pilot display NORM.
 - e. AHRS NORM.
 - f. ADC NORM.
 - g. TUNE NORM.
 - h. RMT TUNE NORM.
 - i. Slew ±, Center.
 - j. DG FREE/NORM NORM.
 - k. GND COM EXTINGUISHED.
- 7. Power console and Pedestal CHECKED. (LS)
 - a. Power levers IDLE, FRICTION SET.
 - b. Prop levers FULL FORWARD, FRICTION SET.
 - c. Condition levers FUEL CUTOFF, FRICTION SET.
 - d. Engine controls friction locks SET.
 - e. Oxygen controls CHECK.

- (1) Passenger manual drop-out CONFIRM PUSHED OFF.
- (2) System ready CONFIRM ON.
- #8. Landing gear alternate extension handle STOWED. (LS)
- 9. Electric heat AS REQUIRED WITH GPU.
 - a. Battery VERIFY ON.
 - b. External power source TURN OFF, CONNECT TO AIRPLANE; TURN ON.
 - c. Voltmeter EXT PWR (27.5 28.4 VOLTS).
 - d. External power ON [EXT PWR] ILLUMINATED.
 - e. ECS mode ELEC HEAT [ELEC HEAT ON] ILLUMINATED.

CAUTION

Do not operate the electric heat with the pedestal floor outlet blocked or the cockpit door closed. [ELEC HEAT ON] must extinguish when ELEC HEAT mode is de-selected. Electric heat must be off at least 2 minutes prior to and during engine start.

- 10. Circuit breakers CHECKED. (BOTH)
- #11. Pilot's static air source NORMAL. (RS)
- 12. Battery ON. (LS)

CAUTION

OVHD PED and SUBPANEL lights and MISSION POWER shall be verified off before applying aircraft battery power in order to prevent possible damage to electrical components.

- 13. Annunciators CHECKED. (RS)
- 14. Engine Warning Tones System Test CHECKED (LS).
 - a. Place and hold TEST switch (Figure 2-14) in the TRANSIENT position. Verify a repetitive 430 Hz tone is heard in the pilot's headset, copilot headset (for dual pilot operations only), and cockpit speaker.
 - b. Depress and release the TRANSIENT MUTE button. Verify the tone is no longer heard.
 - c. Place and hold TEST switch (Figure 2-14) in EXCEED position. Verify a repetitive 3,000 Hz tone is heard in the pilot's headset, copilot headset (for dual pilot operations only), and cockpit speaker.
- 15. Pilot's subpanel CHECKED. (LS)
 - #a. Landing gear control lights TEST.
 - #b. Hydraulic fluid sensor TEST, [HYD FLUID LO] ILLUMINATED.
 - c. EXT LTS MODE SW As Required.
 - d. Beacon and Nav Lights ON.
- #16. Copilot's subpanel CHECKED. (RS)
 - a. Cabin altitude warning TEST, [CABIN ALT HI] and [CABIN ALTITUDE] ILLUMINATED.

- b. Cabin differential warning TEST, [CABIN DIFF HI] ILLUMINATED.
- c. Stall and landing gear warning TEST (note aural warnings).
- d. Fire Detector and Extinguisher TEST, Left and Right [ENG FIRE] ILLUMINATED, Left and Right [EXTINGUISHER PUSH] and [DISCHARGED] ILLUMINATED.
- 17. Fuel quantity CHECKED. (LS)
 - a. Check main, auxiliary, and extended range fuel levels.
- 18. Doors/Cabin LOCKED/CHECKED. (RS/TA)
 - a. Cargo door LOCKED.
 - (1) Check upper handle position CLOSED and LATCHED (Observe through the handle access cover window).
 - (2) Check that the orange index marks on each of the four rotary cam locks align within the indicator windows.
 - (3) Check lower pin latch handle position CLOSED and LATCHED (Observe through the handle access cover window).
 - (4) Check the the orange-colored indicator aligns with orange stripe on carrier rod. (Observe through window at lower left corner).

Note

The untapered shoulder of the latching pins must extend past each attachment lug.

- b. Airstair door LOCKED. (RS/TA)
 - (1) Close and lock the door.
 - (2) Check the position of the safety arm and diaphragm plunger. (Lift the door step).
 - (3) Check that the orange index marks on each of the six rotary cam locks align within the indicator windows.

Note

Only a crew member or properly trained ground personnel should close and lock the airstair door and cargo door.

- c. Load and baggage CONFIRM SECURED.
- d. Seats and table POSITIONED.
 - (1) All seats SEAT BACK UPRIGHT; HEADRESTS FULLY EXTENDED.
 - (2) Lateral-tracking seats OUTBOARD POSTION.
 - (3) Table Stowed.
- 19. Passenger Brief Complete.
 - a. Mission:
 - (1) Estimated time en route.
 - (2) Destination.
 - (3) Weather.
 - b. Exits (location and use).

- c. Oxygen (location, demonstration, aural/visual warning signals).
- d. Emergency survival equipment:
 - (1) Lifevests (location and use).
 - (2) Liferaft/survival kit Location.
- e. Forced landing/ditching positions As required.
- f. Takeoff/landing:
 - (1) Seats upright.
 - (2) Seatbelts fastened/adjusted.
 - (3) Armrests down.
- g. Environmental/pressurization (lights and air outlets).
- h. Comfort station.
- i. Prohibited items.

7.2.4 Engine Starting Checklist

Note

- Starting with environmental bleed air off will provide cooler engine starts.
- During engine start, the ITT value may exceed the set Transient and Exceedance trip points (Figure 2-13) triggering the appropriate tone. Monitor the engine start parameters per the AFM engine limitations.
- 1. Gen Ties (for night operation) MAN CLOSE. (LS)
- 2. Propeller area CLEAR. (BOTH)
- 3. Engines START. (LS)
 - a. Right ignition and engine start ON [R IGNITION ON] ILLUMINATED, [R FUEL PRES LO] EXTINGUISHED.
 - b. Right condition lever (after 12% N₁, minimum) LOW IDLE.
 - c. Right ITT and N₁ MONITOR (1,000 °C maximum).



If no ITT rise is observed within 10 seconds after moving the Condition Lever to LOW IDLE, move the Condition Lever to CUTOFF and release the Ignition and Engine Start Switch to OFF. Allow 5 minutes for fuel to drain and starter to cool, then follow Engine Clearing procedures.

- d. Right oil pressure CHECK.
- e. Right ignition and engine start (at 50% N₁ or above) OFF.
- f. Right condition lever HIGH IDLE.
- g. Right generator RESET, THEN ON [R DC GEN], [L GEN TIE OPEN] and [R GEN TIE OPEN] EXTINGUISHED.
- h. Battery CHARGE (until loadmeter reads approximately 50% or less).

- i. Left ignition and engine start ON [L IGNITION ON] ILLUMINATED, [L FUEL PRES LO] EXTINGUISHED.
- j. Left condition lever (after 12% N₁, minimum) LOW IDLE.
- k. Left ITT and N_1 MONITOR (1,000 °C maximum).
- 1. Left oil pressure CHECK.
- m. Left ignition and engine start (at 50% N_1 or above) OFF.
- n. Right condition lever REDUCE TO LOW IDLE.
- 4. Condition levers LOW IDLE. (LS)
- 5. Left and right prop rpm 1,050 MINIMUM. (LS)
- 6. [L PROP PITCH] and [R PROP PITCH] ILLUMINATED. (LS)
- 7. Voltage and generators CHECKED and RESET. (LS)
 - a. Voltmeter L GEN (voltmeter 27.5 to 29.0 volts).
 - b. Left generator RESET, THEN ON [L DC GEN] EXTINGUISHED.
 - c. Right generator RESET, THEN ON [L GEN TIE OPEN] and [R GEN TIE OPEN] REMAIN EXTINGUISHED WITH SWITCH IN THE RESET POSITION.

7.2.5 Before Taxi Checklist

Note

Items marked with an "#" may be omitted at pilot's discretion after the first flight of each day.

- #1. Electrical system CHECKED. (LS)
 - a. Gen Ties OPEN, [L GEN TIE OPEN] and [R GEN TIE OPEN] ILLUMINATED.
 - b. Voltmeter:
 - (1) TPL FED 26.5 TO 28.0 VOLTS.
 - (2) R GEN and L GEN 27.5 TO 29.0 VOLTS (within 1.0 volt of each other).
 - (3) CTR 23 VOLTS MINIMUM.
 - c. Gen Ties NORM, [L GEN TIE OPEN] and [R GEN TIE OPEN] EXTINGUISHED.
 - d. Bus sense Momentarily to TEST [L GEN TIE OPEN], [R GEN TIE OPEN], and [BAT TIE OPEN] ILLUMINATED.
 - e. Voltmeter CTR 0 VOLTS.
 - f. Bus sense Momentarily to RESET [L GEN TIE OPEN], [R GEN TIE OPEN], and [BAT TIE OPEN] EXTINGUISHED.
 - g. Voltmeter CTR 27.5 TO 29.0 VOLTS.
 - h. Generator load Observe paralleled within 10%.
- 2. Avionics master switch ON. (LS)
- 3. MSN PWR ON. (RS)
- 4. Mission equipment AS REQ. (RS)
 - a. ARC-210 operational mode switch As required.

- b. GPS No. 3 power ON.
- c. TCN-500 TACAN mode selector knob As required.
- d. APX-119 transponder master switch As required.
- e. ALE-47 SET.
 - (1) Master panel lights switch ON.
 - (2) OVHD and PED SUBPAN Adjust for CDU brightness.
 - (3) JETT switch OFF.
 - (4) MODE switch STBY (note proper OFP/MDF and observe BIT).
 - (5) PRGM switch 1 to 4 (as required).
 - (6) CDU enable switches (RWR/JMR/MWS/01/02/CH/FL) ON (as required).

WARNING

Inadvertent placement of the JETT switch in JETT will cause expendables to be dispensed independent of MODE switch position (including OFF) unless: the safety pin is fully engaged; the ALE-47 has Weight On Wheels (WOW); the Mission power switch is OFF; or the FLARE PWR circuit breaker is pulled.

- f. AAR-47 SET.
 - (1) PWR switch ON.
 - (2) AUDIO/BRIGHTNESS knobs ADJUST.
- 5. Furnishings AS REQ. (RS)
- 6. FSB ON. (RS)
- 7. Environmentals SET. (RS)

(Observe N₁, ITT, and generator limits if air conditioning or electric heat is used).

- a. Automatic climate control As required.
 - (1) ECS mode AUTO.
 - (2) Cockpit/Cabin temp As required.
 - (3) Cockpit/Cabin blower AUTO.
 - (4) Envir bleed air AUTO.
 - (5) Bleed air valves OPEN or ENVIR OFF.

Note

Use ENVIR OFF for more efficient cooling on the ground.

- b. Manual control cooling As required.
 - (1) ECS mode MAN COOL.
 - (2) Cockpit/Cabin temp As required.
 - (3) Cockpit/Cabin blower As required.
 - (4) Envir bleed air AUTO.

(5) Bleed air valves — OPEN or ENVIR OFF.

Note

Use ENVIR OFF for more efficient cooling on the ground.

- c. Manual control heating As required.
 - (1) ECS mode MAN HEAT.
 - (2) Cockpit/Cabin temp As required.
 - (3) Cockpit/Cabin blower As required.
 - (4) Envir bleed air As required.
 - (5) Bleed air valves OPEN.
 - (6) Man temp Incr/Decr As required.



Longer than 2-3 second switch actuations and shorter than 60 seconds in between switch activation may result in a duct overheat situation. Follow Chapter 13, Abnormal Procedures if this occurs.

Note

It is the pilot's responsibility to monitor bleed air temperatures in MAN HEAT.

- d. Recirculation blowers As required.
 - (1) ECS mode OFF.
 - (2) Cockpit/Cabin blower As required.

Note

The blowers will not operate in the AUTO mode with ECS OFF or in MAN HEAT.

- (3) Electric heat control As required.
- (4) ECS mode ELEC HEAT, [ELEC HEAT ON] ILLUMINATED.



Use of electric heat is for ground operations only. Do not operate the electric heat with the pedestal floor outlet blocked or the cockpit door closed. [ELEC HEAT ON] must extinguish when ELEC HEAT mode is de-selected.

Note

When in use the cockpit blower will default to high speed and is not adjustable. Operation may affect the accuracy of the magnetic compass.

- 8. FMS CHECKED and SET. (BOTH)
 - a. The RS Pilot/NFO will set the FMS IAW Rockwell Collins FMS-3000 Operators Guide the Beechcraft King Air 90GT/C90GTi/B200/B200C/B200GT/B200CGT/B300. The LS Pilot will check the flight plan is correctly loaded before EXEC is selected.

- #9. Flaps CHECKED and SET. (BOTH)
 - a. Move to and verify that they stop at TAKEOFF and APPROACH.
 - b. Set for takeoff as desired.
- #10. Ice protection equipment CHECKED. (LS)
 - a. Windshield anti-ice (check pilot's and copilot's one at a time).
 - (1) Windshield anti-ice HI (observe increase on left and right loadmeters).
 - (2) Windshield anti-ice OFF, THEN NORMAL (observe increase on left and right loadmeters).
 - (3) Windshield anti-ice OFF.
 - b. Electrothermal propeller deice CHECK.

CAUTION

Do not operate propeller deice when the propellers are static.

- (1) Automatic prop deice ON.
- (2) Deice ammeter 26 to 32 AMPS (monitor for 90 seconds to ensure automatic timer operation).
- (3) Manual prop deice HOLD IN MANUAL POSITION.
 - (a) A small needle deflection on both loadmeters indicates that the manual system is operating.
 - (b) Deice ammeter 0 AMPS.
- (4) Manual prop deice RELEASE.
- (5) Deice ammeter 26 to 32 AMPS.
- (6) Automatic prop deice OFF.

Note

Use of electrical current for the manual (backup) system is not registered on the propeller deice ammeter; however, it will be indicated as part of the electrical load on the loadmeters (approximately 10%) when the system is switched on.

- c. Surface Deice CHECK.
 - (1) Condition levers HIGH IDLE, IF REQUIRED.
 - (2) Pneumatic pressure CHECK.
 - (3) Surface Deice switch SINGLE AND RELEASE.
 - (a) Pneumatic pressure MOMENTARY DECREASE.
 - (b) [WING DEICE] and [TAIL DEICE] ILLUMINATED, THEN EXTINGUISHED.
 - (c) Boots CHECK VISUALLY, WHERE POSSIBLE, FOR INFLATION AND HOLD DOWN.
 - (d) Inflation time 6 SECONDS FOR WINGS FOLLOWED BY 4 SECONDS FOR HORIZONTAL STABILIZER.
 - (4) Surface Deice switch MANUAL AND HOLD.
 - (a) Pneumatic pressure MOMENTARY DECREASE.

- (b) [WING DEICE] and [TAIL DEICE] ILLUMINATED.
- (c) Boots CHECK VISUALLY, WHERE POSSIBLE, FOR INFLATION.
- (5) Surface Deice switch RELEASE.
 - (a) [WING DEICE] and [TAIL DEICE] EXTINGUISHED.
 - (b) Boots CHECK VISUALLY, WHERE POSSIBLE, FOR HOLD DOWN.
- (6) Condition levers LOW IDLE.
- d. Brake deice As required.

If brakes require deicing, do the following:

- (1) Bleed air valves OPEN.
- (2) Brake deice ON, [L BK DEICE ON] and [R BK DEICE ON] ILLUMINATED.
- (3) Condition levers HIGH IDLE (until brakes are deiced, then LOW IDLE).
- (4) Brake deice OFF, [L BK DEICE ON] and [R BK DEICE ON] EXTINGUISHED.
- #11. Engine Anti-ice CHECKED and ON (system initially ON). (LS)

WARNING

Either the MAIN or STANDBY actuator must be operational on each engine before takeoff.

- a. Engine anti-ice actuators STANDBY.
- b. Engine anti-ice OFF, [L ENG ANTI-ICE] and [R ENG ANTI-ICE] EXTINGUISHED.
- c. Engine anti-ice actuators MAIN.
- d. Engine anti-ice ON, [L ENG ANTI-ICE] and [R ENG ANTI-ICE] ILLUMINATED.
- 12. ESIS display INITIALIZATION COMPLETE. (RS)
- 13. Overspeed warning TESTED. (RS)
- 14. Prop sync ON.
- 15. TCAS II TESTED TA/RA and ABOVE. (RS)
 - a. MFD Press TFC KEY more than 1 second to select the TCAS ONLY map.
 - b. CDU Access the TCAS control page and press LSK R2 to access the TCAS TEST mode.
 - (1) TCAS II test pattern will display on the MFD.
 - (2) TCAS TEST message will be displayed on the PFDs and the MFD.
 - (3) The red TRAFFIC message will be displayed on the PFDs.
 - (4) TCAS II vertical speed test pattern will be displayed on the IVSIs.
 - (5) The aural message "TCAS SYSTEM TEST OK" will be heard over the speakers and headsets at the conclusion of a successful test.
 - (6) Ensure that MODE is set to "TA/RA" and ALT LIMITS is set to "ABOVE" on the TCAS CONTROL page.
- 16. IFF CHECKED AND SET (AS REQ). (RS)

Note

The following is a consolidated and abbreviated procedure based on information contained in Chapter 19. Refer to Chapter 19 for complete information on the description and operation of the APX-119.

- a. ATC revisionary switch Verify IFF selected.
- b. APX-119 Master Switch STBY. The APX-119 will power up and indicate a quick flash of the M4 REPLY light and dashes in the alphanumeric display and run a BIT. When the BIT is complete, the alphanumeric display will read STBY.
- c. SEL A/SEL B Switch Momentarily hold up (SEL A) to select/set the following Mission Menu Functions:
 - (1) M3 Toggle the S-1, S-2, S-3, or S-4 switch to input the desired Mode 3/A Code.
 - (2) ETCS Toggle the S-1, S-2, S-3, or S-4 switch to display ETCS OF. E-TCAS enabled (ETCS ON) applies to formation flights only.
 - (3) M1 Toggle the S-1 or S-2 switch to input the desired Mode 1 Code (as required).
 - (4) FMCODES Entry of Formation Member Codes applies to formation flights only.
 - (5) ATC Toggle the S-1, S-2, S-3, or S-4 switch to display ATC ON. Air Traffic Control disabled (ATC OF) function applies to formation flights only.
 - (6) BCST Toggle the S-1, S-2, S-3, or S-4 switch to display BCST OF. Broadcast Function enabled (BCST ON) applies to formation flights only.
- d. SEL A/SEL B Switch Momentarily hold down (SEL B) to select/set the following Maintenance Menu Functions:
 - (1) RNG Toggle the S-1, S-2, S-3, or S-4 switch to select the desired TCAS Range.
 - (2) DISP Toggle the S-1, S-2, S-3, or S-4 switch to adjust the Display Brightness.
 - (3) M2 Toggle the S-1, S-2, S-3, or S-4 switches to input desired Mode 2 Code (as required).
 - (4) MODE S Toggle the S-1, S-2, S-3, or S-4 switch to enable or disable Mode S (as required).
 - (5) MS ADDR Toggle the S-1 or S-4 switch to move the asterisk over the desired digit, toggle the S-2 or S-3 switch to select Mode S Address digits from 0 to 7 (as required).
 - (6) MS FltID Toggle the S-1 or S-4 switch to move the asterisk over the desired character, toggle the S-2 or S-3 switch to select Mode S Flight Identification characters from 0 to Z (as required).
 - (7) RT TYPE Toggle the S-1, S-2, S-3, or S-4 switches to select RT 1717.
 - (8) ANT TEST Antenna Test. Maintenance Function Only.
 - (9) CP TEST Control Panel Self-Test. Maintenance Function Only.
- e. Mode 4 Code Switch Select A or B (as required).



To prevent damage to the switch, pull outward on MASTER switch knob before turning the switch from SBY to OFF, and before turning it from TA/RA to EMER. Release the knob after the new position (OFF or EMER) is selected.

Note

- The C-12W has the APX-119 compact control panel installed P/N 4077156-0504. References to E-TCAS functionality, including Formation Member (FM) codes, ATC on/off, or Broadcast mode, and to TCAS range rings are configurable options that are available on the compact control panel.
- For Mission Menu selection, an asterisk (*) is displayed in the left most position on the alphanumeric display when non-standard conditions are enabled/disabled.
- With MASTER switch set to STBY, display shows STBY for approximately 3 seconds, then setup information for 15 seconds. When STBY displayed, all switches (except MASTER switch) are effectively disabled.
- The Mode 3/A code can be accessed from any menu location by holding the SEL A/SEL B switch to SEL A until the Mode 3/A code appears in the display.
- If configured, E-TCAS operation requires entry of FM Codes (Mode 3/A codes) of the member aircraft flying in formation.
- When E-TCAS is disabled, the transponder and E-TCAS System will operate as a normal TCAS system which generates appropriate advisories based upon the position of the MASTER switch (TA or TA/RA) and the proximity of other aircraft. When E-TCAS is enabled, the control panel must have aircraft Formation Member status defined. Aircraft that are defined as leader (ATC ON) will receive traffic and resolution advisories from the TCAS processor. Aircraft that are defined as Formation Member (ATC OF) will receive traffic advisories only from the TCAS processor and will not respond to Mode 3/A, Mode C, Mode S All-Call, and Mode S UF11 interrogations.
- E-TCAS is disabled automatically when Mode S is disabled.
- When Mode S is disabled, FM codes cannot be modified.
- When Mode S is disabled, Mode S flight identification cannot be modified.
- ANT TEST should be disabled for most operational configurations.
- If ANT TEST is enabled, Mode S and TCAS are disabled until ANT TEST is disabled. Antenna test enables the separate testing of the top or bottom antenna.
- If Mode 4 code has expired, set Mode 4 Code Switch to B.
- If landing gear has been cycled (up and down), automatic zeroizing of Mode 4 codes will occur unless the Mode 4 Code Switch is momentarily placed in the HOLD position and released prior to turning the MASTER switch to the STBY position.
- 17. EMER FREQ EXTINGUISHED. (RS)
- #18. Vacuum and deice pressure CHECKED. (RS)
 - a. L and R Bleed air switches On.
 - b. Left bleed air switch PNEU AND ENVIR OFF.
 - (1) Pneumatic pressure and vacuum gages NORMAL PRESSURE.
 - (2) [L BLEED FAIL] and [R BLEED FAIL] EXTINGUISHED.
 - c. Right bleed air switch PNEU AND ENVIR OFF.

- (1) Pneumatic pressure and vacuum gages ZERO PRESSURE.
- (2) [L BLEED FAIL] and [R BLEED FAIL] ILLUMINATED.
- d. Left bleed air switch OPEN OR ENVIR OFF.
 - (1) Pneumatic pressure and vacuum gages NORMAL PRESSURE.
 - (2) [L BLEED FAIL] and [R BLEED FAIL] EXTINGUISHED.
- e. Right bleed air switch OPEN OR ENVIR OFF.
 - (1) Pneumatic pressure and vacuum gages NORMAL PRESSURE.
 - (2) [L BLEED FAIL] and [R BLEED FAIL] EXTINGUISHED.
- 19. Pressurization CHECKED AND SET. (RS)
 - a. Environmental bleed air NORMAL.
 - b. Bleed air valves OPEN.
 - #c. Pressurization controller SET.
 - (1) Adjust cabin altitude knob to indicate 1,000 feet below field pressure altitude.
 - (2) Set rate knob to 12-o'clock position.
 - #d. Cabin pressure switch HOLD AT THE TEST POSITION.
 - #e. Cabin altimeter and VSI CHECK FOR DESCENT INDICATION.
 - #f. Cabin pressure switch RELEASE TO PRESS POSITION.
 - g. Pressurization controller SET.

Note

The inner scale (ACFT ALT) should indicate planned cruise altitude plus 1,000 feet. This setting must not result in an outer scale (CABIN ALT) indication of less than 500 feet above departure field pressure altitude.

20. TAWS+ — TESTED. (LS)

Note

TAWS+ cannot be tested in flight.

- a. Verify avionics on and the following equipment is functioning:
 - (1) Radio altimeter.
 - (2) ADC1 and ADC2.
 - (3) AHRS1 and AHRS2.
 - (4) GPS1.
 - (5) Gear and flap indicating system.
 - (6) Display system (PFD and MFD).
 - (7) FMS.
- b. Ensure all TAWS+ inhibit switches (G/S INHIB, TERR INHIB, and FLAP OVRD) are deselected.
- c. Verify no TAWS+ inoperative mode messages (amber GPWS or TERR) are displayed on the PFD.
- d. Select present position map and TERR for display on the MFD. Verify no TERRAIN FAIL message is present.

- e. Conduct a self-test of the system by depressing the G/S INHIB annunciator switch and releasing. The following annunciations and alerts should be issued:
 - (1) Aural "TERRAIN AWARENESS TEST START".
 - (2) Amber GPWS and TERR annunciators on the PFD and TERRAIN FAIL on the MFD.
 - (3) A momentary illumination of the G/S INHIB and FLAP OVRD annunciator switches (ACTIVE).
 - (4) Amber GND PROX message on the PFD.
 - (5) A red PULL UP message on the PFD.
 - (6) Test pattern on the MFD terrain display.
 - (7) Terrain display test pattern removed and all TAWS+ messages and annunciator switches extinguished.
 - (8) Aural "TERRAIN AWARENESS SYSTEM PASSED".
 - (9) Aural "TERRAIN AWARENESS TEST COMPLETE".
- 21. Flight and engine instruments CHECKED. (BOTH)
 - a. Altimeters SET.
 - b. ESIS altimeter SET.
- 22. Avionics and Radar CHECKED AND SET. (RS)
- #23. Autopilot and Yaw damp CHECKED. (BOTH)
 - a. Pitch trim TAKEOFF POSITION.
 - b. Elevator FORWARD POSITION.
 - c. Autopilot ENGAGE, [AP] ILLUMINATED on PFD.
 - d. Electric pitch trim OPERATE IN BOTH DIRECTIONS (AP disengages with each operation and the YD remains engaged).
 - e. Elevator CENTERED.
 - f. Autopilot ENGAGE.
 - (1) Apply rearward pressure on the elevator Pitch trim travels nose-down.
 - (2) Apply forward pressure on the elevator Pitch trim travels nose-up.
 - g. AP/Trim disconnect DEPRESS TO FIRST LEVEL MOMENTARY RED [AP] AND AMBER [YD]
 ILLUMINATED, THEN EXTINGUISHED ON PFD.
 - h. Repeat items a. through g. for copilot's side.
 - i. Yaw damp ON, Green [YD] ILLUMINATED on PFD.
 - j. Rudder pedals CHECK FOR ADDED RESISTANCE.
 - k. AP/Trim disconnect PRESS TO 1st LEVEL, Yellow [YD] flashes and rudder pedals move freely.
- 24. Electric pitch trim CHECKED. (BOTH)
 - a. Pilot's and Copilot's Trim Switches CHECK OPERATION.
 - (1) Move each dual-element switch fore and aft VERIFY TRIM IS INOPERATIVE.
 - (2) Move both dual-element switches fore and aft VERIFY TRIM OPERATES NOSE DOWN AND NOSE UP.
 - (3) Make sure pilot's trim switch overrides copilot's trim switch.

- b. AP/Trim disconnect PRESS TO 2ND LEVEL Red [TRIM] ILLUMINATED on PFD.
- c. Release disconnect switch [TRIM] EXTINGUISHED.

WARNING

Operation of the electric pitch trim system should occur only when both elements of the dual-element switch are activated. Any movement of the elevator trim wheel while activating only one element denotes a system malfunction.

- 25. Flight controls FREE AND CORRECT. (LS)
 - a. Check for full freedom of movement and direction of travel.
- 26. V Speeds SET. (LS)
- 27. Takeoff brief COMPLETE. (LS)

7.2.6 Taxi Checklist

- 1. Lights As Required. (LS)
- 2. Brakes CHECKED. (BOTH)
- 3. Flight instruments CHECKED. (BOTH)
 - a. Check and set flight instruments IAW Rockwell Collins Pro Line 21 Avionics System with IFIS Operator's Guide for the Beechcraft King Air.

7.2.7 Engine Runup Checklist

Note

Items marked with an "#" may be omitted at pilot's discretion after the first flight of each day.

- #1. Rudder boost switch CHECKED AND ON. (RS)
 - a. Rudder boost switch OFF [RUD BOOST OFF] ILLUMINATED.
 - b. Rudder boost switch RUDDER BOOST [RUD BOOST OFF] EXTINGUISHED.
- #2. Overspeed governors and Rudder boost CHECKED. (LS)
 - a. Prop levers FULL FORWARD.
 - b. Prop governor test switch HOLD TO GOV.
 - c. Power levers (individually) INCREASE UNTIL PROP IS STABILIZED AT 1,500 TO 1,610 RPM. CONTINUE TO INCREASE UNTIL RUDDER MOVEMENT IS NOTED (right power lever, right rudder; left power lever, left rudder. Observe ITT and torque limits).
 - d. AP/Trim disconnect DEPRESS TO 1ST LEVEL (rudder boost is interrupted), [RUD BOOST OFF] ILLUMINATED.
 - e. Release disconnect switch [RUD BOOST OFF] EXTINGUISHED.
 - f. Power lever IDLE.
 - g. Repeat steps c. through f. on the opposite engine.
 - h. Prop governor test switch RELEASE.

- #3. Low pitch stops and Primary governors CHECKED. (LS)
 - a. Prop levers FULL FORWARD.
 - b. Low pitch stop switch HOLD TO GND IDLE STOP [L PROP PITCH] and [R PROP PITCH] ILLUMINATED.
 - c. Power levers SET 1,500 RPM.
 - d. Prop levers CYCLE TO LOW AND HIGH RPM (propeller RPM decreases then returns to 1,500 RPM).
 - e. Low pitch stop switch RELEASE [L PROP PITCH] and [R PROP PITCH] EXTINGUISHED.
 - f. Prop RPM STABILIZED AT 1,150 TO 1,250.
- #4. Autofeather and Engine auto-ignition CHECKED. (LS)
 - a. Autofeather switch HOLD TO TEST.
 - b. Power levers APPROXIMATELY 22% TORQUE [L AFX] and [R AFX] ILLUMINATED.
 - c. Power levers RETARD INDIVIDUALLY.
 - (1) At approximately 17% torque OPPOSITE ANNUNCIATOR EXTINGUISHED.
 - (2) At approximately 10% torque BOTH ANNUNCIATORS EXTINGUISHED (prop starts to feather).

Note

Autofeather annunciators cycle on and off with each fluctuation of torque as the prop feathers.

- d. Power levers IDLE [L AFX] and [R AFX] EXTINGUISHED (neither prop feathers).
- e. Autofeather switch RELEASE.
- f. Engine auto-ignition CHECK.
 - (1) Power levers IDLE.
 - (2) Engine auto-ignition switches ARM, [L IGNITION ON] and [R IGNITION ON] ILLUMINATED.
 - (3) Power levers ADVANCE TO ABOVE 17% TORQUE, [L IGNITION ON] and [R IGNITION ON] EXTINGUISHED.
 - (4) Power levers IDLE, [L IGNITION ON] and [R IGNITION ON] ILLUMINATED.
 - (5) Engine auto-ignition switches OFF, [L IGNITION ON] and [R IGNITION ON] EXTINGUISHED.
- 5. Autofeather ARM. (LS)
 - a. Armed [AUTOFTHER OFF] EXTINGUISHED.
- 6. Manual propeller feathering CHECKED. (LS)

7.2.8 Before Takeoff Checklist

- 1. Static takeoff power CONFIRM. (LS)
- 2. Fuel quantity, flight, and engine instruments CHECKED AND SET. (LS)
- 3. Bleed air valves SET. (RS)
- 4. ECS Mode, Cockpit/Cabin Blowers and Temps AS REQ. (RS)

a. ECS mode — AS REQUIRED.

CAUTION

Use of electric heat is for ground operations only and should not be selected for takeoff or flight operations. [ELEC HEAT ON] must extinguish when ELEC HEAT mode is de-selected.

- b. Cockpit/Cabin blower AS REQUIRED.
- c. Cockpit/Cabin temp AS REQUIRED.
- 5. Generator load CHECKED. (RS)
 - a. When OAT is greater than 10 °C.
 - (1) A/C ON: Loadmeters must be 30% or less.
 - (2) A/C OFF: Loadmeters must be 50% or less.
- 6. Battery ammeter BELOW 10 AMPS. (RS)
 - a. Charge current 10 amps or less if required.
- 7. Prop levers FULL FORWARD. (LS)
- 8. Trim controls 0/0/2 UP. (LS)
 - a. Rudder and aileron SET TO "0" UNITS.
 - b. Elevator SET TO "2" UNITS NOSE UP.
- 9. Flaps SET. (RS)

7.2.9 Lineup Checklist

- 1. Exterior lights SET. (LS)
- 2. Engine anti-ice AS REQ. (LS)
 - a. [L ENG ANTI-ICE] and [R ENG ANTI-ICE] ILLUMINATED (if on).
- 3. Ice protection SET. (LS)
 - a. Windshield Anti-ice NORMAL/HI (if required).
 - b. Prop Deice AUTO (if required).
 - c. Left and right fuel vent heat ON.
 - d. Stall warning heat ON.
 - e. Left and right pitot heat ON [L PITOT HEAT] and [R PITOT HEAT] EXTINGUISHED.
- 4. Transponder/IFF ATC OR TA/RA (AS REQ). (RS)
 - a. If using the Collins TDR-94 transponder select ATC on the reversionary switch panel.
 - b. If using the APX-119 IFF transponder, turn the Master Switch to TA/RA.
- 5. Radar AS REQ. (RS)
- 6. ALE-47 ARM (AS REQ). (RS/TA)
 - a. MODE switch MAN or SEMI or AUTO (as required).
 - b. Safety switch flag pin REMOVE.

- 7. Auto-ignition ARMED. (LS)
 - a. If required, [L IGNITION ON] and [R IGNITION ON] ILLUMINATED if armed.
- 8. Heading SET. (RS)
- 9. Annunciators CONSIDERED. (RS)

7.2.10 Climb Checklist

- 1. Landing gear and lights UP and OFF. (PF)
- 2. Flaps UP. (PNF)
 - a. Verify airspeed is above 135 Knots (Blueline) prior to raising the flaps.
- 3. Engine instruments MONITOR. (PNF)
- 4. Yaw damp ENGAGED. (PNF)
- 5. Prop levers 1,600 RPM, OR AS DESIRED. (PF)
- 6. Climb power SET.
- 7. Windshield Anti-ice/Defog AS REQ. (PF)

Note

The practice of turning the windshield anti-ice on early in the flight is recommended if it is anticipated that it will be required later in the flight after the windshield has been cold-soaked. Activating the windshield anti-ice after the windshield has been cold-soaked may cause the windshield to crack.

- 8. Bleed Air Valves OPEN. (RS)
- 9. Pressurization CHECKED. (PNF/TA)
- 10. Fuel Transfer CHECKED. (PF)
- 11. Wings and Nacelles CHECKED. (BOTH)

7.2.11 Climb Transition Checklist

- 1. Altimeters STD SET, CROSS CHECKED. (BOTH)
- 2. Recognition lights OFF. (PNF)

7.2.12 Cruise Checklist

WARNING

Do not lift Power Levers in flight.

Note

Power settings and performance shall be predicated on the OAT from the pilot's side console display and not from the temperature displayed on the pilot's PFD and MFD.

- 1. Prop levers 1,500 OR AS DESIRED. (PF)
- 2. Cruise power SET. (PF)

a. SET IAW CRUISE POWER TABLES OR GRAPHS.

CAUTION

Values for Maximum Cruise torque settings taken from the Performance Supplement shall not be exceeded. Any torque setting above these values will decrease the service life and reliability of the engines and could lead to exceedance of an engine and/or airframe limitation.

- 3. Autofeather OFF. (LS)
- 4. ECS mode AS DESIRED. (PNF)
- 5. Engine instruments MONITOR. (BOTH)
- 6. TCAS NORM/AS REQ. (PNF)
- 7. Fuel Quantity MONITOR. (PF)
 - a. FMS PERF INIT Manually update fuel.

Note

- Fuel is transferred from the auxiliary tanks first and then from the main fuel tanks.
- When the extended range fuel tanks are filled, they are utilized first. When they are depleted, fuel is then transferred from the auxiliary fuel tanks, and lastly from the main fuel tanks.
- 8. FSB AS REQ. (PNF)

7.2.13 Descent Checklist

- 1. Pressurization SET. (PNF/TA)
 - a. Cabin altitude SET.
 - b. Rate control AS DESIRED.

Note

With bleed air set to LOW, approximately 75% N_1 is required to maintain the pressurization schedule during descent. With bleed air set to NORMAL, 62% N_1 will maintain the pressurization schedule during descent.

- 2. TCAS BELOW/AS REQ. (PNF)
- 3. Windshield anti-ice AS REQ. (PF)
- 4. Brake deice AS REQ. (PF)
 - a. If on, [L BK DEICE ON] and [R BK DEICE ON] ILLUMINATED.

Note

- Perform if conditions exist that may have restricted the brakes by ice accumulations from previous ground operations or inflight icing conditions.
- If automatic timer has terminated brake deice operation after last retraction of the landing gear, the landing gear must be cycled to obtain further operation of the brake deice system.

- 5. Window Defog AS REQ. (PF)
- 6. Cabin equipment POSITIONED. (PNF/TA)
 - a. All seats SEAT BACKS UPRIGHT; HEADRESTS FULLY EXTENDED.
 - b. Lateral-tracking seat OUTBOARD POSITION.
 - c. Table Stowed.

7.2.14 Descent Transition Checklist

- 1. Altimeter SET, CROSS CHECKED. (BOTH)
- 2. Recognition lights ON. (PF)

7.2.15 Approach Checklist

Note

- If residual ice remains on the airplane, increase V_{REF} speeds by 15 knots. Refer to A1-C12WA-NFM-200, Performance Data Supplement, for landing distances.
- If either a non-precision or visual approach is being used at an airport and there is active ILS frequency at the airport tuned into NAV1, then unwarranted "GLIDESLOPE" cautions may be annunciated. To prevent this, either tune NAV1 to another frequency or select the G/S INHIB switch/annunciator before starting the approach.
- 1. Altimeters SET, CROSS CHECKED. (BOTH)
- 2. V_{REF} and Minimums SET. (PNF)
 - a. Landing (V_{REF}) .
 - b. Approach climb ($V_{REF} + 10 \text{ knots}$).
 - c. Balked Landing (V_{REF}).

V _{REF} — FLAPS DOWN				
LANDING WT LBS (KGS)	V_{REF} — KNOTS			
16,500 (7,484)	110			
16,000 (7,257)	108			
15,675 (7,110)	107			
15,000 (6,804)	105			
14,000 (6,350)	104			
13,000 (5,897)	104			
12,000 (5,443)	104			
11,000 (4,990)	104			

- 3. Avionics/Radar/Flight Instruments CHECKED and SET. (BOTH)
 - a. Check and set flight instruments IAW Rockwell Collins Pro Line 21 Avionics System with IFIS Operator's Guide for the Beechcraft King Air.

- 4. Approach brief COMPLETE. (PF)
- 5. Autofeather ARMED. (LS)
- 6. Environmental Bleed Air LOW. (PNF)
- 7. FSB ON. (PNF)
- 8. Cabin SET. (PNF)
- 9. Flaps APPROACH. (PNF)

7.2.16 Landing Checklist

- 1. Landing gear handle DOWN. 3 GREEN. (PF)
- 2. EXT LTS MODE SW As Required.
- 3. Prop Sync ON. (PF)
- 4. Prop levers 1,700 RPM. (PF)
- 5. Surface deice As Required. (PF)
- 6. Flaps DOWN. (PNF)
- 7. Yaw damp OFF. (PF)

7.2.17 After Landing Checklist

- 1. ALE-47 SAFE. (RS/TA)
 - a. Safety switch flag pin INSERT.
 - b. MODE switch STBY or OFF (as required).
- 2. Engine auto-ignition OFF. (LS)
- 3. Engine anti-ice ON. (LS)

CAUTION

To minimize ingestion of ground debris, the engine anti-ice system should be ON for all ground operations.

- 4. Exterior and interior lights AS REQ. (LS)
- 5. Ice protection OFF. (LS)
- 6. IFF Mode 4 Code Switch HOLD (AS REQ). (RS)
- 7. Transponder/IFF STBY (AS REQ). (RS)
 - a. If using the Collins TDR-94 transponder, place the ATC reversionary switch to STBY.
 - b. If using the APX-119 IFF transponder, place the Master Switch to STBY.
- 8. Radar STBY. (RS)
- 9. Trim controls 0/0/2 UP. (RS)
 - a. Rudder and aileron SET TO "0" UNITS.
 - b. Elevator SET TO "2" UNITS NOSE UP.
- 10. Flaps UP. (RS)

- 11. Pressurization differential ZERO. (RS)
- 12. Bleed air valves ENVIR OFF. (RS)

7.2.18 Shutdown and Securing Checklist

1. Parking brake — SET. (LS)

CAUTION

- Avoid setting the parking brake when the brakes are hot from severe usage, or when moisture conditions and freezing temperatures could form ice locks.
- The parking brake should be left off and wheel chocks installed while the airplane is unattended. Changes in ambient temperature can cause the brakes to release or to exert excessive pressures.
- 2. Avionics Master OFF. (LS)
- 3. Mission equipment OFF. (RS)
 - a. ARC-210 operational mode switch OFF.
 - b. GPS No. 3 power OFF.
 - c. TCN-500 TACAN mode selector knob OFF.
 - d. APX-119 transponder master switch OFF.
 - e. ALE-47 OFF.
 - (1) MODE Switch OFF.
 - (2) Master panel lights switch AS REQUIRED.
 - f. AAR-47 PWR switch OFF.
- 4. MSN PWR switch OFF. (RS)
- 5. ESIS power OFF. (LS)
- 6. Autofeather OFF. (LS)
- 7. ECS mode OFF. (RS)
- 8. Cockpit/Cabin blower AUTO. (RS)
- 9. Oxygen controls PUSH Off. (LS)
- 10. Battery CHARGED. (RS)
- 11. Brake Deice ON, THEN OFF AS REQ. (LS)
 - a. [L BK DEICE ON] and [R BK DEICE ON] ILLUMINATED (when the brake deice is turned on).
 - b. [L BK DEICE ON] and [R BK DEICE ON] EXTINGUISHED (when the brake deice is turned off).

Note

Brake deice control valves may become inoperative if valves are not cycled periodically. One cycle of the valves is required during each flight regardless of weather conditions.

12. ITT — STABILIZED ONE MINUTE. (LS) (At minimum obtainable temperature.)

- 13. Instrument emergency lights AS DESIRED. (RS)
 - a. If desired for a night shutdown ON.
- 14. Condition levers FUEL CUTOFF. (LS)
 - a. Monitor ITT during shutdown. If sustained combustion is observed, proceed immediately to the Engine Clearing procedure. During shutdown, ensure that the compressors decelerate freely. Do not close the firewall fuel valves for normal engine shutdown.
- 15. Prop levers FEATHER. (LS)
- 16. Overhead panel switches OFF. (RS)
- 17. Exterior lights OFF. (LS)
- 18. Cabin entry lights AS REQUIRED. (RS)
- 19. Battery and generator switches (below 15% N_1) OFF. (LS)

Note

- N₁ decreasing below 15% indicates the starter relay is not engaged.
- BAT BUS switch should remain in the NORM position. This switch provides battery bus power to the entry lights, clocks, ground COM and other items on the battery bus.
- 20. Control locks INSTALLED. (LS)
- 21. Instrument emergency lights OFF. (RS)
- 22. Tie-downs and chocks INSTALLED.

7.2.19 GPU Start Checklist



Never connect an external power source to the airplane unless a battery indicating a charge of at least 20 volts is in the airplane. If the battery voltage is less than 20 volts, the battery must be recharged, or replaced with a battery indicating at least 20 volts, before connecting external power.

Note

- When an external power source is used, ascertain that it is capable of generating a minimum of 1,000 amps momentarily and 300 amps continuously. The battery should be ON to absorb transients present in some external power units.
- OVHD PED and SUBPANEL lights and MISSION POWER shall be verified off before applying aircraft battery power in order to prevent possible damage to electrical components.
- 1. Battery VERIFY ON. (LS)



External power source output voltage — SET 28.0 to 28.4 volts.

2. Gen Ties (for night operation) — MAN CLOSE. (LS)

- 3. Voltmeter BATTERY 20.0 VOLTS MINIMUM. (RS)
- 4. External power OFF. (LS)
- 5. Avionics master OFF. (LS)
- 6. Left and right generators OFF. (LS)
- 7. Battery bus NORM. (LS)
- 8. Beacon ON. (LS)
- 9. External power source TURN OFF; CONNECT TO AIRPLANE; TURN ON.
- 10. Voltmeter EXT PWR 28.0 TO 28.4 VOLTS. (RS)
- 11. External power ON, [EXT PWR] ILLUMINATED. (LS)
- 12. Prop levers FEATHER. (LS)
- 13. Propeller area CLEAR. (BOTH)
- 14. Engine Start.
 - a. Right ignition and engine start ON, [R IGNITION ON] ILLUMINATED, [R FUEL PRES LO] EXTINGUISHED.
 - b. Right condition lever (after 12% N₁, minimum) LOW IDLE.
 - c. Right ITT and N₁ MONITOR (1,000 °C maximum).

CAUTION

If no ITT rise is observed within 10 seconds after moving the Condition Lever to LOW IDLE, move the Condition Lever to CUTOFF and release the Ignition and Engine Start Switch to OFF. Allow 5 minutes for fuel to drain and starter to cool, then follow Engine Clearing procedures.

- d. Right oil pressure CHECK.
- e. Right ignition and engine start (at 50% N₁, or above) OFF.
- f. Left ignition and engine start ON, [L IGNITION ON] ILLUMINATED, [L FUEL PRES LO] EXTINGUISHED.
- g. Left condition lever (after 12% N₁, minimum) LOW IDLE.
- h. Left ITT and N_1 MONITOR (1,000 °C maximum).
- i. Left oil pressure CHECK.
- j. Left ignition and engine start (at 50% N_1 , or above) OFF.
- 15. External power OFF. (LS)
- 16. External power source TURN OFF; DISCONNECT FROM AIRPLANE; SECURE DOOR.
- 17. [EXT PWR] VERIFY EXTINGUISHED. (RS)
- 18. Right generator RESET, THEN ON.
 - a. Check [R DC GEN], [L GEN TIE OPEN] and [R GEN TIE OPEN] EXTINGUISHED. (LS)
- 19. Voltmeter L GEN (voltmeter 27.5 to 29.0 volts). (LS)
- 20. Left generator RESET, THEN ON. (LS)

- a. Check [L DC GEN] EXTINGUISHED.
- 21. Right generator RESET, THEN ON. (LS)
 - a. Observe [L GEN TIE OPEN] and [R GEN TIE OPEN] REMAIN EXTINGUISHED WITH SWITCH IN THE RESET POSITION.
- 22. Prop levers FULL FORWARD. (LS)
- 23. Left and right prop rpm 1,050 MINIMUM. (LS)
- 24. [L PROP PITCH] and [R PROP PITCH] ILLUMINATED. (LS)

7.2.20 Left Engine Restart (Ground)

- 1. ECS mode OFF. (RS)
- 2. Bleed air valves ENVIR OFF. (RS)
- 3. Left propeller FULL FORWARD. (LS)
- 4. Right condition lever HIGH IDLE. (LS)
- 5. Prop area CLEAR.
- 6. Left engine START. (LS).
 - a. Right condition lever HIGH IDLE.
 - b. Left ignition and engine start ON [L IGNITION ON] ILLUMINATED, [L FUEL PRES LO] EXTINGUISHED.
 - c. Left condition lever (after 12% N₁, minimum) LOW IDLE.

CAUTION

If no ITT rise is observed within 10 seconds after moving the Condition Lever to LOW IDLE, move the Condition Lever to CUTOFF and release the Ignition and Engine Start Switch to OFF. Allow 5 minutes for fuel to drain and starter to cool, then follow Engine Clearing procedures.

- d. Left ITT and N₁ MONITOR. (1,000 °C maximum).
- e. Left oil pressure CHECK.
- f. Left ignition and engine start. (at 50% N_1 or above) OFF.
- g. Right condition lever REDUCE TO LOW IDLE.
- 7. Condition levers LOW IDLE. (LS)
- 8. Left and right prop rpm 1,050 MINIMUM.
- 9. [L PROP PITCH] and [R PROP PITCH] ILLUMINATED.
- 10. Voltage and generators CHECKED AND RESET.
 - a. Voltmeter L GEN (voltmeter 27.5 to 29.0 volts).
 - b. Left generator RESET, THEN ON [L DC GEN] EXTINGUISHED.
 - c. Right generator RESET, THEN ON [L GEN TIE OPEN] AND [R GEN TIE OPEN] REMAIN EXTINGUISHED WITH SWITCH IN THE RESET POSITION.

7.2.21 Before Taxi: Post Pax-Dropoff/Pickup

This procedure may optionally be used in lieu of the normal BEFORE START, BEFORE TAXI, and ENGINE RUNUP checklists. It combines required items from all three checklists with minor sequence adjustments. This checklist shall only be used between flight legs when at least one engine and all systems remain on.

- 1. Pilot seats and rudder pedals ADJUSTED. (BOTH)
- 2. Seatbelts and shoulder harnesses FASTENED. (BOTH)
- 3. Parking brake CONFIRM SET. (LS)
- 4. Chocks REMOVED. (LS)
- 5. Doors/Cabin LOCKED/CHECKED. (RS/TA)
 - a. Cargo door LOCKED.
 - (1) Check upper handle position CLOSED and LATCHED (Observe through the handle access cover window).
 - (2) Check that the orange index marks on each of the four rotary cam locks align within the indicator windows.
 - (3) Check lower pin latch handle position CLOSED and LATCHED (Observe through the handle access cover window).
 - (4) Check that the orange-colored indicator aligns with orange stripe on carrier rod. (Observe through window at lower left corner.)

Note

The untapered shoulder of the latching pins must extend past each attachment lug.

- b. Airstair door LOCKED. (RS/TA)
 - (1) Close and lock the door.
 - (2) Check the position of the safety arm and diaphragm plunger. (Lift the door step.)
 - (3) Check that the orange index marks on each of the six rotary cam locks align within the indicator windows.

Note

Only a crewmember or properly trained ground personnel should close and lock the airstair door and cargo door.

- c. Load and baggage CONFIRM SECURED.
- d. Seats and table POSITIONED.
 - (1) All seats SEAT BACKS UPRIGHT; HEADRESTS FULLY EXTENDED.
 - (2) Lateral-tracking seats OUTBOARD POSITION.
 - (3) Table Stowed.
- 6. Power console and Pedestal CHECKED. (LS)
 - a. Power levers IDLE, FRICTION SET.
 - b. Prop levers FULL FORWARD, FRICTION SET.
 - c. Condition levers LOW IDLE, FRICTION SET.
 - d. Engine controls friction locks SET.

- e. Oxygen controls CHECK.
 - (1) Passenger manual drop-out CONFIRM PUSHED OFF.
 - (2) System ready CONFIRM ON.
- 7. Circuit breakers CHECKED. (BOTH)
- 8. Passenger Brief Complete
 - a. Mission:
 - (1) Estimated time en route.
 - (2) Destination.
 - (3) Weather.
 - b. Exits (location and use).
 - c. Oxygen (location, demonstration, aural/visual warning signals).
 - d. Emergency survival equipment:
 - (1) Lifevests (location and use).
 - (2) Liferaft/survival kit Location.
 - e. Forced landing/ditching positions As required.
 - f. Takeoff/landing:
 - (1) Seats upright.
 - (2) Seatbelts fastened/adjusted.
 - (3) Armrests down.
 - g. Environmental/pressurization (lights and air outlets).
 - h. Comfort station.
 - i. Prohibited items.
- 9. Furnishings AS REQ. (RS)
- 10. FSB ON. (RS)
- 11. FMS (Synchronize, if required) CHECKED AND SET. (BOTH)
 - a. The RS Pilot/NFO will set the FMS IAW Rockwell Collins FMS-3000 Operators Guide the Beechcraft King Air 90GT/C90GTi/B200/B200C/B200GT/B200CGT/B300. The LS Pilot will check the flight plan is correctly loaded before EXEC is selected.
- 12. Engine Anti-ice ON. (LS)



Either the MAIN or STANDBY actuator must be operational on each engine before takeoff.

- 13. Pressurization SET. (RS)
 - a. Pressurization controller SET.

Note

The inner scale (ACFT ALT) should indicate planned cruise altitude plus 1,000 feet. This setting must not result in an outer scale (CABIN ALT) indication of less than 500 feet above departure field pressure altitude.

- 14. Avionics and Radar CHECKED AND SET. (RS)
- 15. Flight controls FREE AND CORRECT. (LS)
 - a. Check for full freedom of movement and direction of travel.
- 16. V Speeds SET. (LS)
- 17. Autofeather ARM. (LS)
 - a. Armed [AUTOFTHER OFF] EXTINGUISHED.
- 18. Manual propeller feathering CHECKED. (LS)
- 19. Takeoff brief COMPLETE. (LS)

Resume normal checklist procedures from BEFORE TAKEOFF.

7.3 OTHER PROCEDURES

7.3.1 Oxygen Duration

Note

A bottle at 1,850 psig at 15 °C is fully charged (100% capacity).

- 1. Read the oxygen pressure from the gage.
- 2. Read the IOAT (with battery on). (Assume IOAT to be equal to BOTTLE TEMPERATURE).
- 3. Determine the percent of usable capacity from Figure 7-2 (e.g., 1,100 psig at $0 \, ^{\circ}\text{C} = 57\%$).
- 4. Compute the oxygen duration in minutes by multiplying the full bottle duration from Figure 7-3 by the percent of usable capacity.
 - a. Pilot and copilot with masks set at 100% plus 6 passengers = 10 people using oxygen.

Note

Pilot and copilot are each counted as 2 people with the diluter demand masks set at the 100% or EMERG mode.

- b. Cylinder volume = 77 cubic feet.
- c. Duration with full bottle = 48 minutes.
- d. Duration with 57% capacity = $0.57 \times 48 = 27$ minutes.

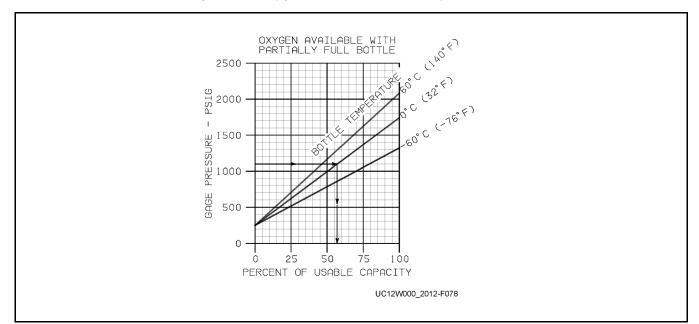


Figure 7-2. Oxygen Available with Partially Full Bottle

Figure 7-3. Oxygen Duration with Full Bottle (100% Capacity)

OXYGEN DURATION WITH FULL BOTTLE (100% CAPACITY)										
STATED CYLINDER SIZE		*NUMBER OF PEOPLE USING								
		1	2	3	4	5	6	7	8	9
CU FT	LITERS	DURATION IN MINUTES								
77	2,181	488	244	162	122	97	81	69	61	54
STATED CYLINDER SIZE		*NUMBER OF PEOPLE USING								
		10	11	12	13	14	15	*16	*17	
CU FT	LITERS	DURATION IN MINUTES								
77	2,181	48	44	40	37	34	32	30	28	
* The pilot and copilot are each counted as 2 people with crew masks set at the 100% or EMERG mode.										

7.3.2 Practice Landing Gear Manual Extension

- 1. Airspeed BELOW 182 KNOTS.
- 2. Landing Gear Relay circuit breaker on Left Subpanel (Figure 2-4) PULL.
- 3. Landing gear control DOWN.
- 4. Alternate extension handle UNSTOW.
- 5. Alternate extension handle PUMP UP AND DOWN (until the [L], [R], and [NOSE] ILLUMINATE and further resistance is felt).
- 6. Alternate extension handle STOW.

Note

Ensure the Extension Handle is in the full down position prior to placing the Extension Handle in the securing clip.

7.3.3 Landing Gear Retraction After Practice Manual Extension

After a practice manual extension of the landing gear, the gear may be retracted as follow:

- 1. Alternate extension handle STOW.
- 2. Landing Gear Relay circuit breaker on Left Subpanel (Figure 2-4) PUSH IN.
- 3. Landing gear UP.

7.3.4 Noise Characteristics

Approach to and departure from an airport should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.

For VFR operations over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas, pilots should make every effort to fly not less than 2,000 feet above the surface, weather permitting, even though flight at lower level may be consistent with the provisions of government regulations.

Note

The preceding recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgement, an altitude of less than 2,000 feet is necessary to adequately exercise his duty to see and avoid other airplanes.

The take-off noise level established in compliance with 14 CFR Part 36, Appendix G, is 81.45 dB (A).

No determination has been made by the Federal Aviation Administration that the noise level of this airplane is, or should be, acceptable or unacceptable for operation at, into, or out of any airport.

The take-off noise level established in compliance with ICAO Annex 16, Chapter 10, is 81.45 dB (A).

7.3.5 Ground Communications

The Ground Communications (GND COM) switch provides electrical power directly from the battery without turning the aircraft power on. Turning on the GND COM allows operation of the No. 1 VHF, No. 1 FMS CDU, and audio is provided in the headphones and speaker as selected. Activation of the battery switch will result in automatic disconnection of the ground communications system. The normal method for deactivation of the system is accomplished by pressing the GND COM switch.

7.3.5.1 Using Ground Communications

- 1. System activation.
 - a. Battery and generators OFF.
 - b. GND COM power switch PRESS, [ON] ILLUMINATED.

Note

Activation of this system by any means other than the prescribed procedure is not approved.

2. System deactivation.

GND COM power switch — PRESS, [ON] — EXTINGUISHED.



Ensure the ground communications power switch is off before leaving the airplane so a drain on the battery will not occur.

7.3.5.2 Transponder Selection

The FMS Control Display Unit (CDUs) provides control selection for transponder codes and TCAS control when the Collins transponder is selected. The CDUs will allow selection of the Collins No. 1 Transponder (ATC1) with TCAS control, or to select the external control to support the IFF transponder control. This selection switch is located in the reversionary panel (Figure 2-7) and is labeled "ATC 1", "STBY", "IFF".

Note

- If an amber "IFF" is displayed on the Caution/Advisory/Status panel whenever the IFF is selected, the IFF applique was installed but no IFF code of the day was entered. If the entire IFF system is operational, or no applique is installed, no amber light will be displayed.
- The "Ident" function works properly from the IFF control head. However, the remote "Ident" feature that normally functions from each control wheel is inoperative.

7.3.5.3 FMS Message

The white MSG displayed on each PFD indicates presence of an FMS message that requires pilot awareness and may require pilot action. Refer to the Collins FMS-3000 Flight Management System Pilot's Operating Manual, under Messages and Annunuciations, Section 15.

MFD FMS map source data is controlled by the menu button on the CCP, when a map is displayed on the MFD.

The EFIS transition altitude FL alert caution setting is controlled from the FMS VNAV setup page.

7.3.5.4 FMS CDU — GPS Control

With the third GPS installed (Trimble GPS), the settings on the GPS CONTROL page are as follows:

- 1. The default setting is GPS1 ENABLED, GPS2 ENABLED, and GPS3 DISABLED.
- 2. If both GPS1 and GPS2 are ENABLED and if GPS1 is subsequently set to DISABLED, GPS2 remains ENABLED.
- 3. If both GPS1 and GPS2 are ENABLED and if GPS2 is subsequently set to DISABLED, GPS1 remains ENABLED.
- 4. If GPS3 is set to ENABLED while GPS1 and/or GPS2 is ENABLED, GPS1 and GPS2 are automatically set to DISABLED.
- If GPS3 is subsequently DISABLED, GPS1 and GPS2 remain DISABLED until they are manually ENABLED.
- 6. If GPS3 is ENABLED and GPS1 or GPS2 is manually set to ENABLED, then GPS3 is automatically set to DISABLED.
- 7. When both GPS1 and GPS2 are ENABLED, the default sensor for FMS1 is GPS1 and the default sensor for FMS2 is GPS2.
- 8. Each side of the FMS is independent from the other for GPS source selection. For example, GPS3 can be ENABLED (which causes GPS1 to become DISABLED) on the pilot's side, while GPS1 and GPS2 remain ENABLED on the copilot's side.

7.3.5.5 3rd Trimble GPS Control

Normal settings for GPS No. 3 controller, located in the pedestal, are:

- 1. Power ON.
- 2. Mode SPS.
- 3. Zeroize Depressing this switch clears past loaded precision codes (no effect in SPS mode).
- 4. Load Valid light Extinguished when operating in SPS mode.
- 5. Fill Connector Safety Cap installed.

7.3.5.6 Onside GPS Set Position

Regardless of which GPS(s) the pilot has enabled, the "Set Pos to GPS" function will be for the onside GPS only once the GPS has reached the NAV condition after start up. Unless there is a GPS failure or reversion.

7.3.5.7 AN/APX-119 IFF Transponder

The IFF Controller, located in the aft pedestal, provides for selection of transponder codes, transponder modes, and TCAS control when selected for use (IFF) via the ATC1, STDBY, IFF located in the reversionary panel. Control is OFF when not selected. Normal modes of operation are as follows:

- 1. MASTER TA/RA. Enables TCAS with Mode S altitude reporting. Provides alternate modes of operation.
- 2. SEL A/SEL B Set to middle position for normal operations.
- 3. S1, S2, S3, S4 Switches Sets transponder code when M-3/A set to ON.
- 4. M-1, M-2, M-3A, M-C Switches All set to ON. M-3A selected to TEST initiates TCAS self-test on the ground.
- 5. RAD TEST Set to OUT. Overrides the weight-on-wheels interlock to provide ground transmission for 1 minute.
- 6. IFF CODE SWITCH Set to A. Mode 4 operation (not available).
- 7. IFF MODE 4 SWITCH Set to OUT. Mode 4 operation (not available).
- 8. IFF AUDIO SWITCH Set to OUT. Mode 4 operation (not available).
- 9. ABOVE/NORMAL/BELOW SWITCH TCAS control. Set as desired.
- 10. IDENT/MIC SWITCH Set to OUT. Used for IDENT of transponder.

7.3.6 Traffic Alert and Collision Avoidance System (TCAS II)

WARNING

The TCAS II does not provide protection from aircraft that do not have an operating transponder. The TCAS II can detect and track aircraft with either an ATCRBS (operating in Mode A or C) or a Mode S transponder.



Optimum TCAS II performance is realized when intruder aircraft are reporting their altitude.

7.3.6.1 Traffic Advisories (TAS)

The pilot must not initiate evasive maneuvers using information only from the traffic display, or from a Traffic Advisory (TA), without visually sighting the traffic. These displays and advisories are intended only for assistance in visually locating the traffic and lack the flight path trends necessary for use in evasive maneuvering. However, modest changes in vertical speed while climbing or descending is not considered evasive maneuvering.

The TA Only Mode should only be used to preclude unnecessary Resolution Advisories (RAs) when intentionally operating near other airplanes such as when conducting approaches to parallel runways that are less than 2,500 feet apart. RAs will not be issued when operating in the TA Only Mode.

7.3.6.2 Resolution Advisories (RAS)

Compliance with TCAS II Resolution Advisory is necessary unless the pilot considers it unsafe to do so, or unless the pilot has better information about the cause of the RA and can maintain a safe separation (e.g., observing a fault in the TCAS, or obtaining a visual contact with the intruder in order to maintain a safe separation). The following must be considered in situations where the crew elects not to follow an RA.

WARNING

Noncompliance with a crossing RA by one airplane may result in reduced vertical separation; therefore, safe horizontal separation must also be assured by visual means.



Once a non-crossing RA has been issued, safe operation could be compromised if current vertical speed is changed, except as necessary to comply with the RA. This is because TCAS II-to-TCAS II coordination may be in progress with the intruder airplane, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the other airplane's compliance with its RA.

Note

The consequences of not following an RA may result in additional RAs in which aural alerts and visual annunciations may not agree with each other.

Because of the limited number of inputs to TCAS II for airplane performance inhibits, in some instances where inhibiting RAs may be appropriate it is not possible to do so. In these cases, TCAS II may command maneuvers which may significantly reduce stall margins or result in stall warning. Therefore, the stall warning must be respected when following an RA. Conditions where this may occur include the following:

- 1. Bank angles in excess of 15°.
- 2. One engine inoperative.
- 3. Abnormal configurations such as being unable to retract the landing gear.
- 4. Leaving the airplane in inappropriate configurations when a CLIMB RA occurs.
- 5. Operation at airports outside of 0 to 5,300 feet MSL or temperatures outside of ISA ±27.8 °C.
- 6. Speeds below normal operating speeds.
- 7. Buffet margin less than 0.3 g.

The TCAS II RA algorithms are based on the pilot initiating the initial 0.25 g incremental maneuver within approximately 5 seconds, and within approximately 2.5 seconds if an additional corrective RA increase or reverse is issued. The reversal is based on a 0.5 g incremental maneuver.

Note

Evasive maneuvering must be limited to the minimum required to comply with the RA. Excessive responses to RAs are not desirable or appropriate because of other potential traffic and ATC consequences. From level flight, proper response to an RA typically results in an overall altitude deviation of 300 to 500 feet in order to successfully resolve a traffic conflict.

Preventive advisories are issued after a corrective advisory has been satisfied and the TCAS II airplane is projected to have adequate altitude separation. The corrective RA is said to soften, indicating a gradual return to the original flight path or ATC clearance is allowed. As the corrective advisory softens to a preventive advisory, the green band is removed, the magnitude of the red band decreased, and MONITOR VERTICAL SPEED is announced. The new preventive RA restricts the vertical speed the pilot may use in returning to the original flight path. The RA may soften several times before CLEAR OF CONFLICT is announced. MONITOR VERTICAL SPEED will be announced only after the initial downgrading of the corrective RA. Utilizing the softening advisory will greatly reduce the ultimate altitude deviation caused by the original corrective resolution advisory.

If a Climb RA is issued while in the landing configuration, initiate the Balked Landing procedures in this section.

Note

Initiating the Balked Landing procedure for a Climb RA does not mandate a missed approach. It is intended to assure the airplane is properly configured for the expected maneuver. In most cases, the TCAS II event will be resolved with only minor deviation to the intended flight path, and sufficient time and altitude may exist to recover safely to the desired flight path.

Following the TCAS II voice message CLEAR OF CONFLICT, the pilot should expeditiously return to the applicable ATC clearance unless otherwise directed by ATC.

Note

There can be a case where the threat aircraft track or altitude information is lost during an RA. In this case, the RA will terminate without a CLEAR OF CONFLICT voice message.

7.3.7 Terrain Awareness and Warning System Plus (TAWS+)

- 1. Operations with the CPA function active, and the GPS position unreliable, may result in nuisance terrain alerts. Select TERR INHIB.
- 2. If there is no terrain data in the database for a particular area, the affected display area is colored magenta.
- 3. In the event the Radio Altimeter is not functioning, the basic GPWS modes will not be available; however, look-ahead terrain alerts will be available.
- 4. The TAWS+ display is available only on the Present Position Map and ARC formats. Selection of weather radar and the terrain display are mutually exclusive.
- 5. Operations within 15 nm of an airport not contained in the TAWS+ database with the CPA function activity may result in nuisance terrain alerts. Select TERR INHIB. Refer to ACSS document 8006417 for airports contained in the database (See "TAWS+ Airports" in www.acsscustomerservices.com).
- 6. If there is no terrain data available in the database for a particular area, the affected display area is colored magenta.

7.3.8 Aircraft Data Acquisition System Plus (ADASd) Normal Procedures

The ADAS^d incorporates a single TREND switch/fault lamp. The TREND lamp is white in color and can be configured to display an exceedance or sensor fault to the pilot as well as an automatic trend sample. The TREND lamp is also a switch, which when depressed, will take a trend sample of specific engine parameters.

When power is first applied to the processor, the TREND switch/lamp will illuminate for approximately 1-5 seconds while the system performs self-tests. If any of these tests fail, the lamp will remain on.

Note

The TREND lamp may momentarily flash during self-test. This is normal and is part of the lamp self-test.

If the test passes, the lamp will extinguish and the processor will enter a system state as described below:

1. Lamp Out — Normal State.

This is the normal condition of the ADASd when all systems checks have passed.

2. Lamp Flashing (depressing lamp will extinguish lamp) — Maintenance State.

When the ADAS^d is in Maintenance State, the processor is 100% full and will not function as an exceedence monitor.

3. Lamp Flashing (depressing lamp will not extinguish lamp) — Caution State.

When the ADAS^d is in Caution State, the system has detected a previous flight exceedence.

4. Lamp Solid — Fault State.

When the ADAS^d is in Fault State, the system has detected a fault condition this will affect its ability to function as an exceedence monitor.

Note

The ADAS^d will extinguish any of the above lamp conditions once an engine is started.

Once the engine has been started, or either engine has started in a dual engine aircraft, the ADAS^d lamp is used to display trend and exceedence information to the pilot and/or crew as follows:

1. Trend Mode

The ADAS^d can be configured to take an automatic trend sample whenever certain engine/flight conditions are met. Once the trend criteria are met, the system will collect a sample of data for later review by maintenance personnel. During this trend sample the ADAS^d lamp will flash at a slow (1 Hz) rate. Pressing the TREND switch will manually initiate the same trend data sample.

2. Event Mode

The ADAS^d processor can be configured to monitor engine parameters and record instances where they have exceeded preset values. Event Mode is defined as anytime the aircraft or engine has met the criteria defined for an event and where the pilot and/or crew would be alerted. These events are typically torque or temperature events. If configured, Event Mode is displayed to the pilot via a 2 Hz lamp flash or a solid lamp.

The event can be configured such the Event Mode can be acknowledged by pressing the TREND switch. If configured this way, the Event Mode lamp display will extinguish when the TREND switch is pressed.

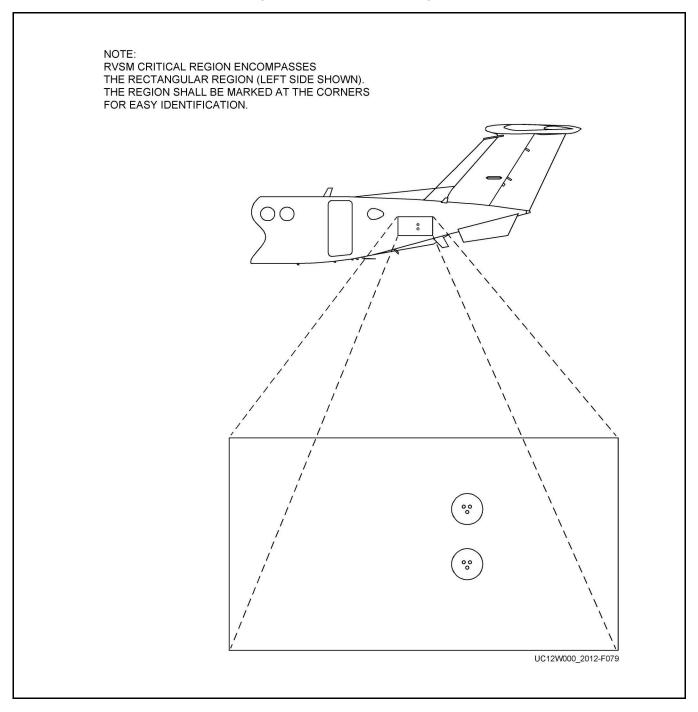
7.3.9 Modular Airborne Data Recording System (MADRAS) Normal Procedures

After Engine Start, the [CDVR/FDR FAIL] light illuminates momentarily (brief flash) then extinguishes, which indicates successful completion on the self-test.

7.3.10 Preparation For Flight In Reduced Vertical Separation Minimum (RVSM) Airspace

Prior to all flights in RVSM airspace, the airplane skin surface in the region surrounding the static ports (RVSM Critical Region) must be inspected (on both the left and right sides of the airframe) for obvious damage or deformation, perhaps due to walkway damage, foreign object damage, service vehicles, etc. The static port surface shall remain free of paint. Each of the static ports must be inspected for abnormal elongation, deformation, and/or obstruction. Ensure that no foreign matter is found within the pressure orifices.

Figure 7-4. RVSM Critical Region



CHAPTER 8

Overwater Operations

8.1 OVERWATER OPERATIONS

To conduct extended overwater operations, the following considerations must be carefully evaluated and all planning factors strictly adhered to. All flights over water shall be planned in accordance with this chapter.

8.1.1 Payload

Because of constraints of maximum allowable takeoff weight and fuel requirements, cabin load/payload must always remain secondary as a mission consideration. The aircraft commander must be prepared to reduce cabin load (i.e., refuse passengers or cargo) based on his evaluation of all factors. In some cases, delay or cancellation to await more favorable conditions may be required.

8.1.2 General Procedure

When involved in overwater flying, the requirement for fuel planning becomes more complex. Because of the lack of available alternates, possible significant en route wind changes, and rapidly changing weather, the fuel planning delineated in this chapter shall be completed for extended overwater flight.

8.2 OVERWATER OPERATIONS DEFINITIONS

8.2.1 Overwater Flight

Defined as flight flown over the high seas or bodies of water where all suitable divert airfield(s), including departure and arrival airports, are located further than 200 nm. (approximately 1 hour at one-engine inoperative max cruise, 18,000 feet, ISA) along any point on the route.

8.2.2 Reserve Fuel

Reserve fuel is additional fuel taken on at the departure point for en route contingencies such as wind variations, temperature deviations, and flight at less-than-optimal altitudes. It is the fuel that can be burned en route in addition to the planned burnoff and still have the required holding fuel at destination, plus alternate fuel if required. Minimum reserve fuel is 10 percent of the planned fuel burn from departure point to destination and then on to the alternate if an alternate is required.

8.2.3 Holding Fuel

Holding fuel is planned fuel for holding at destination or alternate if required. This is the fuel required for holding in cases I, II, and III as defined in paragraphs 8.3.3.1, 8.3.3.2, and 8.3.3.3 respectively. Holding fuel does not include fuel for anticipated Air Traffic Control (ATC) holding, approach procedures, or alternate requirements at the departure or destination airports.

8.2.4 Emergency on Deck Fuel (EODF)

Emergency on Deck Fuel (EODF) is the absolute minimum planned fuel required upon landing after experiencing a rapid decompression or engine failure at the most critical point along the route of flight ETP. Minimum EODF is 500 pounds. Minimum fuel required at ETP is fuel to continue to destination (or divert) plus 500 pounds.

8.2.5 Equal Time Point

The Equal Time Point (ETP) is a point expressed in miles along the track from which the same amount of time will be required to either return to the takeoff point or continue to destination. It is calculated assuming an emergency requiring a descent to 10,000 feet at that point and either continuing to the destination or returning to the departure point with one engine inoperative or at 10,000 feet. It is the most critical point along the route of flight and is used for turnaround decision-making purposes.

ETP (in nm) = Total Distance (nm)
$$X$$
 GS_R $GS_R + GS_C$

Where:

Distance = Total distance from takeoff to destination (nm).

 GS_R = Groundspeed to return to point of departure, based on wind average from the takeoff point to midpoint of flight in nm/hr.

 $GS_R = TAS \pm WIND A$

GS_C = Groundspeed to continue to destination, based on wind average from midpoint to destination nm/hr.

 $GS_C = TAS \pm WIND B$

Wind A = Average wind speed from takeoff point to midpoint of flight.

Wind B = Average wind speed from midpoint of flight to destination.

8.2.6 Point of Safe Return (PSR)

The Point of Safe Return (PSR) is the farthest point along the route to which the aircraft can fly and still return safely to the point of departure. It is predicated on two-engine operation.

PSR (time in hours) =
$$ts = GS_2$$
 X T_1 $GS_1 + GS_2$

PSR (distance in nm) = ds =
$$ts(GS_1)$$

Where:

 T_1 = Flight time based on all fuel on board (in hours) at takeoff except holding for fuel and for flying to departure alternate (in hours).

 GS_1 = Groundspeed from takeoff to midpoint in flight, (nm/hr).

 GS_2 = Groundspeed from midpoint to departure point, (nm/hr).

8.2.7 Point of No Return (PNR)

The PNR is the farthest point along the route to which the aircraft can fly and still return to the point of departure and land with no fuel remaining (predicated on two engines).

PNR (time in hours) = tn =
$$GS_2$$
 X T_2 $GS_1 + GS_2$

PNR (distance in nm) =
$$dn = tn(GS_1)$$

Where:

 T_2 = Flight time based on all fuel aboard (in hours) at takeoff.

 GS_1 = Groundspeed from takeoff to midpoint in flight (nm/hr).

 GS_2 = Groundspeed from the midpoint of the route of flight to the departure point (nm/hr).

8.3 FUEL PLANNING

8.3.1 General Procedure

The appropriate charts in A1-C12WA-NFM-200, Performance Data Supplement, will be utilized for preflight planning, as applicable to the mission profile. When true airspeeds other than maximum cruise power are to be adhered to, the specific range charts shall be considered the primary reference for en route fuel planning.

8.3.2 Computer Flight Plan

A computer flight plan Optimum Path Aircraft Routing System (OPARS) may be utilized for basic fuel/flight planning information. It is, nonetheless, the TPC's responsibility to ensure that reserve and alternate fuel are provided as outlined in current instructions.

8.3.3 Normal Two-Engine Operation

After consideration of destination weather, one of the following formulas shall apply in calculating minimum takeoff fuel. Refer to Figure 8-1 for a summary of fuel planning requirements.

8.3.3.1 Case I

Destination forecast Visual Flight Rules (VFR) ± 1 hour (>3000/3):

Fuel to destination +

10 percent of fuel to destination +

45 minutes holding at maximum endurance and 10,000 feet.

8.3.3.2 Case II

Alternate required:

Fuel to destination +

Fuel to alternate at 10,000 feet +

10 percent of (fuel to destination + fuel to alternate) +.

45 minutes holding at maximum endurance and 10,000 feet.

8.3.3.3 Case III

Island holding (no alternate available):

Fuel to destination +

10 percent of fuel to destination +

1 hour 15 minutes holding at maximum endurance at 20,000 feet.

Figure 8-1. Summary Of Overwater Fuel Planning Requirements

FUEL CATEGORY	CASE I	CASE II	CASE III	
	Dest wx ETA ±1 hr > 3000-3	Dest wx ETA ±1 hr < 3000-3	Island holding NO ALT available	
A. Destination Fuel	Note 1	Note 2	Note 1	
B. Alternate Fuel	N/A	Note 2	N/A	
C. Reserve Fuel	Note 3	Note 4	Note 3	
D. Holding Fuel	Note 5	Note 5	Note 6	
Preliminary Fuel Required	A + C + D Note 7	A + B + C + D Note 7	A + C + D Note 7	

NOTE:

- 1. Fuel required to fly to destination airport. Includes start, taxi, and enroute fuel. When calculating with OPARS, includes appropriate fuel biases for departure, approach and in flight icing.
- 2. Fuel required to fly from destination IAF to alternate airport at 10,000 feet.
- 3. 10% of Fuel to destination.
- 4. 10% of Fuel to destination plus fuel to alternate.
- 5. Fuel required to fly at maximum endurance at 20,000 feet for 75 minutes.
- 6. Fuel required to fly at maximum endurance at 10,000 feet for 45 minutes.
- 7. The greater of preliminary fuel required or emergency fuel required becomes minimum departure fuel. Refer to paragraph 8.3.5.

WARNING

- Zero fuel remains upon exhaustion of planned destination, alternate, reserve and holding fuel.
- When a L or R FUEL QTY annunciator illuminates approx. 300 pounds or 30 minutes of fuel at max continuous power is remaining on that side.

8.3.4 Single-Engine Fuel Planning or Unpressurized Flight Fuel Planning

In the event of an engine failure, a precise estimate of fuel required from the ETP should be considered for the emergency. Variables such as icing, wind changes, or nonstandard temperatures will affect cruise ceilings and fuel usage considerably. With all variables considered, the aircraft must be able to either continue to destination or return to takeoff point on fuel available from single-engine ETP. Methodology and charts for determining single-engine range are contained in A1-C12WA-NFM-200, Performance Data Supplement.

Note

On some overwater legs, a suitable divert field is available near the midpoint. In these cases, although fuel planning shall be in accordance with the above, construction of range control charts and computation of ETP and PSR shall be at the discretion of the aircraft commander.

8.3.5 Fuel Computation

8.3.5.1 ETP

ETP should be computed prior to takeoff and verified en route. An aircraft shall depart with sufficient fuel to proceed to the ETP, experience an engine failure or require depressurized flight, and then continue to either the destination or divert and land with minimum EODF (500 pounds).

8.3.5.2 Depressurization

Fuel planning shall be done assuming an emergency descent to 10,000 feet at the ETP. If there is sufficient oxygen aboard for all passengers and crew, an altitude up to 25,000 feet may be used.

8.3.5.3 Fuel Calculation

- 1. Compute fuel to destination and, if required, to alternate.
- 2. Add a minimum 10 percent and any known additional fuel required (e.g., known ATC delays).
- 3. Compute holding fuel (case I, II, or III).
- 4. Compute preliminary fuel load by totaling items 1 to 3.
- 5. Compute single-engine and depressurized ETP. If using altitudes other than OPARS, use the most adverse altitudes.
- 6. Compute emergency fuel requirements. This is the fuel burn computed from departure point to ETP using normal two-engine figures, plus fuel burn from ETP to destination or departure point after an engine failure or depressurization at ETP plus 500 pounds.
- 7. Compare emergency fuel requirements with preliminary fuel load determined in step 4. The greater will become the minimum departure fuel. Recompute en route burn as required by new aircraft takeoff gross weight.

Note

- If at any point prior to ETP it is determined that fuel at ETP will be less than that required to experience an engine failure or depressurization and land with minimum EODF, the aircraft shall return to the departure point or a suitable divert field.
- OPARS estimates may contain errors.

8.3.5.4 Fuel Evaluation

- 1. A locally prepared fuel range control chart or an OPARS shall be completed.
- 2. All checkpoints on the flight plan will be clearly depicted on the fuel evaluation chart corresponding to planned fuel consumption.
- 3. A 10 percent overage will be calculated for total fuel burn at each point and plotted on the chart. Once plotted, a dark line shall be drawn through the estimated burn points on the chart. A red line shall be drawn through the 10 percent above points to indicate the excessive burn acceptability line. All ETPs, PSRs, and PNRs will be plotted on the chart to provide an immediate reference to all points.

Note

Preliminary ETP, etc. may be plotted based on forecast winds but shall be updated based on actual conditions.

CHAPTER 9

Functional Checkflight Procedures

9.1 GENERAL

9.1.1 Check Pilots

Pilots shall be fully qualified in accordance with this manual and CNAF M-3710.7. Commanding Officers/OICs will designate in writing those pilots within their command who are currently qualified to perform this duty.

9.1.2 Crewmembers

Crewmembers of checkflights shall be qualified to conduct such tests as may be required. Contract maintenance personnel are authorized on functional checkflights as needed or required.

9.1.3 Safety

Safety shall be the governing factor on all post-maintenance checkflights. The following general rules shall apply:

- 1. The flight shall be governed by the requirements of this manual, the Hawker Beechcraft Maintenance Manuals and CNAF M-3710.7.
- 2. Radio communications shall be maintained with the control tower or another appropriate agency at all times. Flight following should be used to the maximum extent possible.
- 3. Checkflights should be flown in a designated area, and those portions of the checkflight that are considered critical shall be conducted in the vicinity of a suitable landing area.

9.1.4 Checkflights and Forms

Checkflights shall be flown in accordance with this chapter and by Hawker Beechcraft Maintenance directives or at such other times as may be directed by NAVAIRSYSCOM, the Commanding Officer/OIC, or other competent authority. Checkflights are required to determine whether the airframe, powerplant, accessories, and items of equipment are functioning in accordance with predetermined requirements while subjected to the intended operating environment. Functional checkflight requirements and applicable minimums are described below. The results of the checks shall be entered on the checklists with appropriate remarks, if necessary, and maintained locally at the completion of the checkflight. All discrepancies discovered during the course of the flight check shall be recorded on appropriate forms.

9.1.5 Briefing

Prior to the checkflight, maintenance personnel shall brief pilots on the maintenance performed on the aircraft, pertinent aircraft history, and the checkflight requirements for the particular flight. The briefing should include the expected results, troubleshooting recommendations and, when appropriate, corrective or emergency action to be taken if required.

9.1.6 Functional Checkflight

NATOPS procedures shall apply during the entire checkflight unless specific deviation is required by the functional check to record data or make sure proper operation within the approved aircraft envelope. The following items provide detailed description of the functional checks, sequenced in order in which they should be performed. In order to complete the checks in the most efficient and logical order, a flight profile (Figure 9-1) has been established for each flight condition and identified by the letter corresponding to the purpose for which the checkflight is being flown. The applicable letter identifying the profile prefixes each check, both in the following text and in the

Functional Checkflight Checklist. Checkflight personnel shall familiarize themselves with these requirements prior to the flight.

Prior to a functional checkflight requiring maximum cruise power, speed checks, stall warning and/or stall checks, the aircraft shall be loaded with full oil, full main tanks, full auxiliary tanks, pilot, copilot, optional equipment, and ballast if required to remain within cg limits. The test weight shall be between 12,600 and 13,000 pounds with the cg between F.S. 197.3 and 200.4. All other checks shall be conducted within normal weight and cg limits.

9.2 FUNCTIONAL CHECKFLIGHT REQUIREMENT

A Functional Checkflight Checklist is required for those conditions wherein probable satisfactory performance in flight cannot be verified by maintenance ground checks. FCFs are required for situations where the risk of malfunction in flight is high or where malfunction of the affected system or component would jeopardize safety of flight beyond reasonable limits.

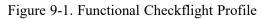
9.3 CONDITIONS REQUIRING CHECKFLIGHT

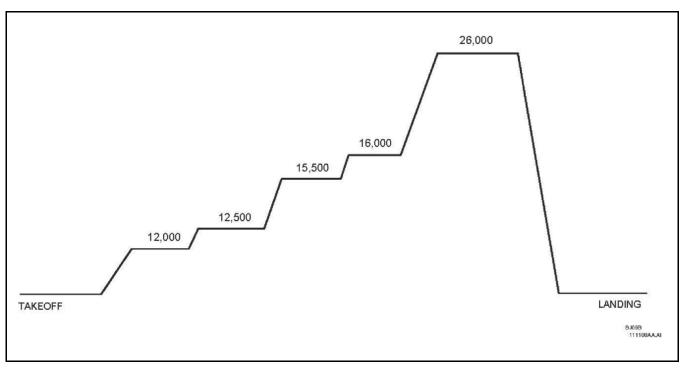
Perform applicable flight profile and associated checks in accordance with the following checkflight conditions (after necessary ground checks and prior to release of aircraft for operational use):

- a. At the completion of aircraft rework, transfer of aircraft custody, or 30 day no-fly. Minimum checks required are prefixed by letter A.
- b. After the installation of an engine, propeller, engine fuel control, or any components that cannot be checked on the ground. Minimum checks required are prefixed by letter B.
- c. When fixed or movable flight surfaces or flight control system components have been installed, reinstalled, adjusted, or re-rigged and improper adjustment or replacement of such components could cause an unsafe operating condition. Minimum checks required are prefixed by letter C.

Note

- The above profiles are general divisions of aircraft maintenance and systems. It is not required to complete all steps in any one profile if the steps are not applicable to the maintenance performed.
- The requirement for a checkflight, under circumstances other than those specified above, is a determination to be made by the On-Site Government Representative (OSGR) and will be based on the scope of the work accomplished and its effect on safety and reliability of operation.





A1-C12WA-NFM-000 PROFILE

9.4 PREFLIGHT

The exterior and interior inspections shall be conducted with special attention directed to all areas where maintenance was performed. If a downing discrepancy is discovered during the preflight, the complete exterior and interior inspections should be completed and all discrepancies recorded on the checklist and Aircraft Maintenance Discrepancy Form.

ABC

Α

- 1. Exterior Inspection.
 - a. Considering the nature of the maintenance performed on the aircraft, appropriate access panel/cowling doors should be opened, and the areas that were worked should be scrutinized closely for proper assembly, leaks, correct rigging, tools, rags, and other foreign objects.
 - b. Check the power plants for security, fuel, and oil leaks.
 - c. Check the landing gear, wheels, tires, struts, brakes, and fire extinguisher bottles for condition and leaks.
 - d. Check the wings, control surfaces, and tabs for general condition and verify that when the control tabs are neutral, the cockpit indications correspond.
 - e. Check the pitot tubes, static ports, and antennas for general condition; also inspect for missing/worn fasteners, the security of access panels, popped/loose rivets, skin irregularities, and general aircraft condition.

2. Interior Inspection.

- a. Check cabin entrance door. Door must lock easily. When closed, lines on door cams should line up with notches on the adjacent door frame brackets and safety lock arm should be in position around the plunger. Check adjustment of door open annunciator light. Check operation of door lowering cylinder; door must lower slowly and smoothly. Check for correct illumination of the CABIN DOOR Annunciator light.
- b. Check cargo door. When closed, visually check that both (upper aft and lower forward) door latching handles are secured by the latch locks and that the lines on the four rotary cam locks align with the notches on the adjacent door frame brackets. Check operation of the door raising cylinders; they must raise the door smoothly and slowly.
- c. Check escape hatch security and key lock/hatch operation.
- d. Passenger/cargo compartment check.
 - (1) Check webbing installation and baggage compartment placard.
 - (2) Check window guards in place (if installed).
 - (3) Check toilet and passenger seats for secure installation.
 - (4) Check seat belt installation for security to each seat.
 - (5) Check fire extinguisher stowed.
- e. Cockpit check.
 - (1) Check fire extinguisher stowed.
 - (2) Normal and emergency checklists.
 - (3) NATOPS manual.

ABC

3. Perform Cabin/Cockpit Preflight Checklist, refer to paragraph 7.2.1.

PROFILE

ABC

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9.5 BEFORE START

- 1. Perform Before Start Checklist, refer to paragraph 7.2.3.
- 2. External Power.
 - a. Battery Switch and External Power Switch Off.
 - b. Connect external power cart to airplane.
 - c. External Power Cart Turn On.
 - (1) Voltmeter Bus Select Switch EXT PWR. Verify 28.0 28.4 volts.
 - d. EXT PWR Annunciator Extinguished.
 - e. Battery Switch On.
 - (1) EXT PWR Annunciator Verify flashing.
 - (2) BAT TIE OPEN Annunciator Extinguished.
 - f. EXT PWR Switch in cockpit On.
 - (1) EXT PWR Annunciator Steady.
 - (2) L and R GEN TIE OPEN Annunciators Extinguished.
 - (3) L and R ENG ICE FAIL Annunciators Extinguished, if illuminated.
 - (4) Verify all buses are powered using the Voltmeter Bus Select Switch.
 - g. AVIONICS MASTER SWITCH On.

9.6 FLIGHT STATION INSPECTIONS

Α

- 1. Instrument Emergency Lighting.
 - a. Instrument Indirect Lights Off.
 - b. Instrument Emergency Lights Switch (overhead panel) Select On.
 - c. Instrument Indirect Lights (4 of 8 bulbs beneath glareshield) Check On.
 - d. Instrument Emergency Lights Switch Select Off.
- 2. Emergency Frequency.
 - a. Select the emergency frequency and verify that the No. 1 Radio auto tunes to 121.5.
 - b. Select EMERGENCY FREQUENCY Off.
- 3. Flight Management System (FMS) and Integrated Flight Information System (IFIS).
 - a. From the Control Display Unit (CDU) perform the following:

9-5

- (1) Select IDX FMS CTL and verify that the FMSs are in SYNC mode. (If Dual FMS system.)
- (2) Update the initial position from IDX POS INT, and then select the appropriate position and paste into the SET POS line.
- (3) Check all NAVAIDs are enabled through IDX GPS and VOR CTL pages.
- (4) Check the following STATUS page information through IDX STATUS.
 - (a) Database.
 - (b) Time.

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- (c) Date.
- (5) Press the MFD MENU button and determine that the various selections are available for display on the MFD display.
- (6) Insert a Flight Plan into the FMS. (If Dual FMS system, verify that the flight plan transfers to the opposite side.)
- (7) Enter the appropriate preflight information using the PERF PERF INIT page.
- b. PFDs and MFD Displays/Display Control Panels (DCP) Perform the following checks on both the pilot and copilot sides.
 - (1) Using the FORMAT line select key on the PFD, check display modes.
 - (2) Check display dimming of PFDs and MFD with the BRT/DIM rocker switch on each display bezel.
 - (3) Check functionality of each button/control on the DCP panel.
 - (a) Determine that the REFS button will bring up the Reference Menus on the PFD display and that items can be selected with the MENU ADV/DATA knobs and Line Select keys.
 - (b) Determine that the NAV/BRG button will bring up the Navigation Menus of the PFD display, and that items can be selected with the MENU ADV/DATA knobs and Line Select keys.
 - (c) Determine that the RADAR button will bring up the Radar Menus on the PFD display, and that items can be selected with the MENU ADV/DATA knobs and Line Select keys. With RADAR in WX mode, press the Ground Suppression (GCS) button and verify that the GCS annunciation replaces the RADAR mode annunciation for approximately 30 seconds.
 - (d) Operate TILT/RANGE knobs and note their operation on the PFD and MFD displays.
- c. MFD Display/IFIS Cursor Control Panel (CCP).
 - (1) Using LOWER FORMAT line select key on the MFD, select each display format.
 - (2) Using the MEM buttons on the CCP, store the PPOS format in MEM 1, the GWX format in MEM 2, and the TCAS format in MEM 3. (To store an MFD display format, hold the appropriate MEM button for a few seconds until store is annunciated on the MFD, then release.)
 - (3) Cycle between display pages using the MEM buttons.
 - (4) Using the UPPER line select key on the MFD, select each display format. Depress the CKLST/EXP button on the control column to select CHKLST.
 - (5) Use the MENU ADV/DATA, PUSH SELECT, and ESC buttons on the CCP to navigate within the electronic checklist and confirm correct operation. Also confirm operation of the LA button on control column.
 - (6) Push STAT then MENU buttons on the CCP to display the STATUS MENU page on the MFD.
 - (7) Rotate the MENU ADV knob and PUSH SELECT to select DATABASE EFFECTIVITY. Confirm correct databases are installed and current. (If CHART subscription available.)

- (8) Push CHART then MENU buttons on the CCP to display CHART MAIN NDX page on the MFD. Verify the ORIGIN, DESTINATION, and ALTERNATE airports displayed agree with the previously entered flight plan data.
- (9) Select the ORIGIN airport diagram for display on the MFD and confirm the aircraft symbol is correctly presented on the display.
- (10) Check functionality of the Chart Rotate and ZOOM buttons and the joystick cursor control for the CHART display formats on the MFD.
- 4. Terrain Awareness and Warning System Plus (TAWS+).
 - a. TERR INHB Verify not selected.
 - b. G/S INHB Button Push to initiate test (Less than 2 seconds to initiate the short test). (The test feature will function only when the airplane is on the ground.)
 - c. Amber GPWS, and TERR Annunciations on PFD ADI Verify illuminated.
 - d. Amber TERRAIN FAIL Annunciation on PFDs and MFD Verify illuminated.
 - e. Single "GLIDESLOPE" aural alert Verify.
 - f. GS/INHB Annunciation on switch Verify momentary illumination.
 - g. Amber GND PROX Annunciation on PFD ADI Verify illuminated.
 - h. Single "PULL UP" aural alert accompanied by red PULL UP Annunciation on PFD ADI Verify.
 - i. "TERRAIN, TERRAIN, PULL UP" aural alert accompanied by red PULL UP Annunciation on PFD ADI Verify.
 - j. Amber GND PROX Annunciation on PFD ADI Verify illuminated.
 - k. Terrain display test pattern on MFD Verify.
 - 1. Terrain display test pattern and annunciations Verify extinguished.

5. TCAS II.

- a. Set up controls as follows:
 - (1) Select transponder 1 or 2 (ATC 1 or ATC 2) and set ALT on using the ATC Control page on the RTU.

Note

ALT need not be on for a successful test.

- (2) Press the TFC line select key on the MFD for more than 1 second to select the TCAS Only format. If previously not selected, TFC will change from white to cyan. (TA ONLY will be displayed in cyan below the TFC line select key if ALT is on. If ALT is off, the message will be TCAS OFF.)
- (3) Select the 5 nm range using the RANGE knob on the Display Control Panel.
- (4) Select the Tune page on the CDU and press R6 to select the TCAS CONTROL page.
- (5) Press R3 (TCAS display) twice on the RTU to select the TCAS Main Display page.
- (6) Make sure the OTHER TRAFFIC symbol ◊ is selected ON.
- b. Press R2 (TEST) on the CDU or activate the TCAS test and verify the following:
 - (1) The white TEST on the CDU will enlarge and change color to cyan.

- (2) TCAS TEST is displayed in cyan on the MFD beneath the TFC line select key.
- (3) A red TRAFFIC message, located below the right lower corner of the EADIs, will blink six times then become steady.
- (4) A red bar will be displayed on the IVSIs from the bottom of the display to zero, and from +2,000 fpm to the top of the scale. A green bar will be displayed from zero to +300 fpm.
- (5) A white TCAS TEST message will appear in the lower right corner of the PFDs, replacing the white TCAS OFF or TA ONLY messages.
- (6) The test will last for approximately 10 seconds and will end with the voice message, "TCAS SYSTEM TEST OK" and the PFDs, MFD, and CDU displays returning to normal

6. HF Radio.

- a. Verify proper operation of the CDU.
 - (1) Set active and recall frequencies, simplex and half-duplex.
 - (2) Adjust the squelch.
 - (3) Change the emission mode.
 - (4) Change the transmission power.
 - (5) Store preset frequencies and channels.
 - (6) Change Tune Mode (FREQ, PRESET, EMER, MAR).
- b. Conduct self-test.
 - (1) Select NEXT page on the CDU to display the HF active and recall frequencies.
 - (2) Press L4 once to select the HF Main Display page.
 - (3) Press R2 (blue TEST) to activate the self-test.
 - (a) The white TEST will enlarge and change color to cyan.
 - (b) After successful completion, green pass will appear in R2.

7. Flight Director.

- a. Autopilot Disengaged.
- b. FD Button Push.
 - (1) Pitch and Roll Annunciations on PFD Displayed. (Flashes initially for approximately 7 seconds, then constant.)
 - (2) Steering Command-Bars on PFD Displayed.
- c. Push FD Button Pitch and Roll Modes and Steering Command Bars Cancelled.
- d. AHRS Switch 2.
- e. FD Button Push, Verify the red FD flag is displayed on PFD.
- f. FD Button Push (OFF).
- g. AHRS Switch NORM.
- h. CPL Button Push to select copilots side.

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i. Copilots PFD — Repeat steps a. through g. (Using the Copilots FD Button and, in step d., AHRS 1.)

8. Autopilot.

An automated pre-engagement test is performed upon avionics power-up. The autopilot will not engage unless this test has been satisfactorily completed since last power-up.

- a. Control Column Pull off the stop and hold.
- b. AP Button Push to engage.
 - (1) Flight Controls Check AP engaged (3 axes).
 - (2) AP Annunciations on PFD Displayed.
 - (3) Pitch and Roll Annunciations on PFD Displayed.
 - (4) Steering Command Bars on PFD Displayed.
 - (5) Push on the control column Verify pitch trim moves NU direction.
 - (6) Pull on the control column Verify pitch trim moves ND direction.
- c. AP Button Push (to 1st level) to disengage.
 - (1) AP Disconnect Horn Activated.
 - (2) Flight Controls Check AP disengaged.
 - (3) Red AP Annunciation on PFD Flashes then extinguishes.
 - (4) YD Remains engaged.
 - (5) Control Column Return to forward stop.
- d. Verify that each of the following additional actions also disengages the autopilot:
 - (1) Pilot and Copilot AP DISENG Button on control wheel Push to 2nd level (AP and YD disengage).
 - (2) Go-Around Button Push (YD remains engaged).
 - (3) Pitch Trim Activation. (YD remains engaged.)
 - (4) AP/YD DISC bar switch Push down.
- e. Push CPL Button to transfer AP control to Copilot and repeat all steps.
- 9. Altitude Alerter.
 - a. Overhead speaker ON.
 - b. Using the CPL button select the AP to the pilots side.
 - c. Pilot's Baroset Knob Adjust to nearest 100-foot altimeter reading.
 - d. Altitude Preselect Knob Set to match altimeter reading.
 - e. Baroset Knob Adjust to increase/decrease altitude.
 - f. At 200 feet from initial altitude, verify the following:
 - (1) Warning horn Sounds for approximately 2 seconds.
 - (2) Altitude Preselect Display on PFDs change color from cyan to amber and starts blinking.
 - g. Altitude Preselect Knob Push to cancel.

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- h. Pilot's Baroset Knob Reset.
- 10. Audio Panels.
 - a. Pilot and Copilot panels Check.
 - (1) Interphone volume levels and clarity.
 - (2) COMM 1 and COMM 2 transmit and receive for volume and clarity through both headsets and overhead speakers; AUTO COMM function.
 - (3) PA System for appropriate level in cabin.
 - (4) NORM and OXY functions. (Check that speaker is automatically selected when MIC selected to OXY then deselected when switch is returned to NORM.)
 - (5) Hand microphone operation.

11. Reversionary Panel.

- a. DISPLAY Switch.
 - (1) Select PFD the MFD blanks; verify composite format on both PFDs.
 - (2) Select MFD the Pilot's PFD blanks; verify composite format on MFD.
 - (3) Select NORM.
- b. AHRS Switch.
 - (1) Select No. 1 Amber AHS1 Annunciation on both PFDs.
 - (2) Select No. 2 Amber AHS2 Annunciation on both PFDs.
 - (3) Select NORM.
- c. ADC Switch.
 - (1) Select No. 1 Amber ADC1 Annunciation on both PFDs.
 - (2) Select No. 2 Amber ADC2 Annunciation on both PFDs.
 - (3) Select NORM.
- d. CDU Switch.
 - (1) Select CDU CDU 2 blanks.
 - (2) Select CDU 2 Left CDU blanks.
 - (3) Select NORM.
- 12. Electric Pitch Trim.
 - a. Master Avionics Switch On.
 - b. Actuate each of the split switches individually.
 - (1) Trim shall not move.
 - (2) After approximately 5 seconds a Flashing Red TRIM will appear on the PFD.
 - (3) Reset trim by pressing the red AP disconnect button on the control wheel to the second level.
 - c. On each control wheel, actuate split switches simultaneously in opposite directions.
 - (1) Trim shall not move.
 - (2) After approximately 5 seconds a Flashing Red TRIM will appear on the PFD.

- (3) Reset trim by pressing the red AP disconnect button on the control wheel to the second level.
- d. On each control wheel, actuate split switches simultaneously in the forward and then in the aft direction.
 - (1) Trim shall move nose-down and then nose-up.
- e. Activate copilots trim switches in one direction and simultaneously activate the pilots trim switches in the other direction.
 - (1) The pilots system shall override the copilots system.
- 13. Primary Flight Controls.
 - a. Elevator, Aileron, and Rudder Operate Through the Full Range Of Travel.
 - (1) There shall be no obstructions or excessive friction.
 - (2) With the elevator pulled fully aft, there shall be no tendency for the control wheel to swing to either side.
 - b. Control Direction Check the Direction of Control Surface Movement with the Direction of the Cockpit Control Movement.
 - c. Rudder Pedals Verify Proper Operation of the Adjustment Mechanism.
- 14. Trim Tab Travel and Direction.
 - a. Operate trim tabs through full range of travel, noting any excessive friction or binding.
 - (1) Make sure the extremes of the elevator trim travel are marked with red lines.
 - (2) Verify full travel of the aileron and rudder trim knobs is approximately symmetrical and lies within the white box.
 - b. Verify proper direction of tab movement at the control surface.
 - c. With the elevator trim set 2 units nose up and the rudder and aileron trim tabs set at neutral, verify neutral position of the tab at the control surface.
 - (1) With the elevator resting against the down stops, the trailing edge of the elevator tab shall align with the trailing edge of the elevator.
 - (2) With the rudder centered, the rudder tab will align with the trailing edge of the rudder.
- 15. Circuit Breakers, Switches, and Controls.
 - a. Fuel Panel Circuit Breakers and Copilots Circuit Breaker Panel All Breakers In.
 - b. Verify all circuit breakers protrude far enough from the panel to allow them to be manually pulled.
 - c. Fuel Panel Switches As Required.
 - d. Pilots Subpanel Switches Off (except for battery and battery bus).
 - e. Copilots Subpanel Switches and Controls Set.
- 16. Engine Control Pedestal.
 - a. Propeller and Condition Levers Verify Freedom of Movement Through Full Range of Travel.
 - (1) RVS NOT READY Annunciator will illuminate when either propeller lever is retarded.

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- Power Levers Verify Freedom of Movement and Smoothness from Idle Through Full Power Range Only. (DO NOT MOVE POWER LEVERS INTO THE GROUND-FINE OR REVERSE POSITIONS.)
 - c. Control Friction Locks Check for Adequate Friction Control.
 - d. Verify that the rubber dust covers are not torn.
- 17. Battery Switch and Bus Ties.
 - a. External Power Switch Off.
 - b. Battery Switch Off.
 - (1) Check battery voltage for 23 volts minimum.
 - (2) All other voltages will be zero (unless external power is connected).
 - c. Battery Switch On.
 - d. Check Bus Voltage with Rotary Voltmeter Bus Select Switch.
 - (1) TPL Bus 22 volts minimum.
 - (2) L and R GEN Bus Zero volts.
 - (3) CTR Bus 23 volts minimum.
 - e. Verify illumination of the following annunciators:
 - (1) Warning.
 - (a) DOOR UNLOCKED (if cabin door is unlocked).
 - (b) L and R FUEL PRES LO.
 - (c) L and R OIL PRES LO.
 - (d) L and R BLEED FAIL.
 - (2) Caution and Advisory.
 - (a) L and R DC GEN.
 - (b) L and R GEN TIE OPEN.
 - (c) RVS NOT READY (if propeller levers are not full forward).
 - (d) L and R NO FUEL XFR.
 - (e) L and R ENG ICE FAIL (if actuator switches are in Standby).
 - (f) AUTOFTHER OFF (if autofeather switch is off).
 - (g) OXY NOT ARMED.
 - (h) L and R ENG ANTI-ICE (if ice vanes are extended).
 - f. GEN TIES Switch MAN CLOSE.
 - (1) L and R GEN TIE OPEN Annunciators Extinguished.
 - (2) L and R ENG ICE FAIL Annunciators (if actuators are in Standby) Extinguished.
 - (3) MAN TIES CLOSE Annunciators Illuminated.
 - g. L and R GEN BUS Voltage Same as BATT voltage.
 - h. Bus Tie Control Circuit Breaker Pull.

- (1) L and R GEN Bus and CTR Bus voltages are zero.
- (2) MAN TIES CLOSE Annunciator remains illuminated.
- (3) BAT TIE OPEN Annunciator Illuminates.
- (4) L and R ENG ICE FAIL Annunciators (if actuators are in Standby) Illuminated.
- (5) Blinking EXT PWR Annunciator Extinguished (if external power is connected).
- i. Bus Tie Control Circuit Breaker Reset.
- Gen Ties Switch OPEN, then NORM.
 - (1) L and R ENG ICE FAIL Annunciators (if actuators are in Standby) Illuminated.
 - (2) L and R GEN TIE OPEN Annunciators Illuminated.
 - (3) MAN TIES CLOSE Annunciator Extinguished.
- k. Battery Switch Off.
 - (1) BAT TIE OPEN Annunciator illuminates and then fades slowly.
 - (2) L and R GEN TIE OPEN Annunciators fade slowly.
- 1. Battery Switch On.
 - (1) HYD FLUID LOW Annunciator illuminates and then extinguishes in approximately 10 seconds.

18. Fuel Quantity.

- a. Fuel quantity indicators shall be checked with full fuel.
- b. Each Main fuel tank shall indicate approximately 1,273 pounds.
- c. Each Auxiliary fuel tank shall indicate approximately 533 pounds.
- d. Each Extended Range fuel tank shall indicate approximately 790 pounds.
- e. L and R FUEL QTY Annunciators will illuminate in approximately 4 seconds when the FUEL QUANTITY Switch is held to the TEST position.

19. Fuel System.

- a. Battery Bus Switch NORM.
- b. Battery Switch On.
- c. Firewall Shut-Off Valves Push to Close.
 - (1) CLOSE illuminated on F/W VALVE PUSH Switches.
 - (2) EXTINGUISHER PUSH illuminated on fire extinguisher switches.
- d. Standby Fuel Pumps On One at a Time.
 - (1) L and R FUEL PRES LO Annunciators remain illuminated.
- e. Firewall Shut-Off Valves Push To Open.
 - (1) CLOSE extinguished on F/W VALVE PUSH Switches.
 - (2) EXTINGUISHER PUSH extinguished on fire extinguisher switches.
 - (3) L and R FUEL PRES LO Annunciators Extinguished.

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f. Standby Fuel Pumps — Off.

(1) L and R FUEL PRES LO Annunciators — Illuminate. Crossfeed Flow — Alternately Left and Right. (1) FUEL CROSSFEED Annunciator — Illuminated. (2) L and R FUEL PRES LO Annunciators — Extinguished. (3) R NO FUEL XFR Annunciator — Extinguished when crossfeeding from right to (4) L NO FUEL XFR Annunciator — Extinguished when crossfeeding from left to right. h. Crossfeed Flow — Off. 20. Fire Detector and Fire Extinguisher. a. Left and Right ENG FIRE TEST Switches — Individually To DET. (1) ENG FIRE Annunciator illuminates on the respective F/W VALVE PUSH. (2) A red FIRE Annunciation illuminates in the center of the respective Torque/ITT indicator. (3) MASTER WARNING Annunciators begin flashing. b. Left and Right ENG FIRE TEST Switches — Individually to EXT. (1) EXTINGUISHER PUSH and DISCHARGED Annunciators illuminate on the respective fire extinguisher switch. 21. Stall Warning and Landing Gear Warning. Α a. Lift Stall Warning Test Switch and verify: (1) Aural Warning. (2) Stall Vane Movement. b. Depress Landing Gear Warning Test Switch and verify: (1) Aural Gear Warning. (2) Illumination Of Lights In The Gear Handle. 22. Cabin Altitude and Cabin Differential Pressure Warning. a. Lift Cabin Altitude Warning Test Switch and verify: (1) Aural Warning. (2) Illumination of the CABIN ALT HI Annunciator. (3) Illumination of the CABIN ALTITUDE Annunciator. b. Depress the Cabin Diff Warning Test Switch and verify: (1) Illumination of the CABIN DIFF HI Annunciator. Hydraulic Fluid Sensor. a. Press and hold the Hydraulic Fluid Sensor test button. (1) Verify that the HYD FLUID LOW Annunciator illuminates after a delay of approximately 4 seconds.

b. Release test button.

PROFILE (1) Verify that the HYD FLUID LOW Annunciator extinguishes after a delay not to exceed 15 seconds. 24. Oxygen System. a. Verify sufficient oxygen bottle pressure. Record results below: Pressure psi. psi. Annunciator Masks b. Oxygen System Ready control — Pull On and verify OXY NOT ARMED Annunciator extinguishes. c. Check crew oxygen masks for proper operation. 25. ESIS Power. a. Battery Switch — OFF. b. ON-OFF-TEST Switch — Hold to Test. (1) Green Annunciator — Illuminated. c. ON-OFF-TEST Switch — ON. (1) Amber ON Annunciator — Illuminated. (2) ESIS starts Power Up. d. Battery Switch — ON (Amber ON Annunciator remains illuminated). e. Gen Ties — MAN CLOSE (Amber Annunciator extinguishes and ESIS remains powered). f. Gen Ties — OPEN (Amber ON Annunciator illuminates). g. Battery Switch — OFF. h. ON-OFF-TEST Switch — OFF. 26. Ground Communication Power Control. a. Battery, AVIONICS MASTER, and External Power — OFF. b. GND COMM PWR Switch — Push On and verify the CDU 1 is powered. c. COMM 1 Radio — Check Operation from both Pilot and Copilot Sides Using: (1) Headsets. (2) Hand mics and speakers. d. Battery Switch — ON. (1) Confirm Ground Comm Power is disconnected. 9.7 ENGINE START **ABC** 1. Perform Engine Starting Checklist, refer to paragraph 7.2.4 or GPU Start Checklist, refer to paragraph 7.2.19. **ABC** 2. Electrical System.

a. After First Engine Start.

- (1) Appropriate Generator Reset and On.
- (2) Verify L and R GEN TIE OPEN Annunciators Extinguish.
- (3) Voltages Check.
 - (a) Battery, R and L GEN, CTR Bus: 27.5 29.0 volts.
 - (b) TPL Bus: 26.5 28.0 volts.
 - (c) EXT PWR Zero volts.
- b. After Second Engine Start.
 - (1) Operating Generator Off.
 - (a) L and R GEN TIES OPEN Annunciators Illuminated.
 - (b) L or R GEN Annunciators Extinguish.
 - (c) L and R ENG ICE FAIL (if Standby Actuators selected) Annunciators Illuminated.
 - (2) Generator of Second Engine Started Reset and On.
 - (a) L and R GEN TIES OPEN Annunciators Extinguished.
 - (b) L and R GEN Annunciators Extinguished.
 - (c) L and R ENG ICE FAIL (if illuminated) Annunciators Extinguished.
 - (3) Voltages Check.
 - (a) Battery, R and L GEN, CTR Bus: 27.5 29.0 volts.
 - (b) TPL Bus: 26.5 28.0 volts.
 - (c) EXT PWR Zero volts.
 - (4) Opposite Generator Reset and On.
- c. GEN TIE Switch Open.
 - (1) L and R GEN TIE OPEN Annunciators Illuminated.
 - (2) Generator Loadmeters Observe a decrease in both loadmeters.
 - (a) Positive Load Indication On each generator.
 - (b) Loadmeter 50% or Less.
 - (3) Verify that the TPL Bus, R GEN Bus, L GEN Bus, and CTR Bus are powered.
 - (a) The CTR Bus shall read battery voltage.
 - (b) The TPL Bus shall read 1 volt less than the L and R GEN Buses.
 - (c) The L GEN and R GEN Buses shall read 27.5 29.0 volts (within 1 volt of each other).
 - (4) Left Generator Off.
 - (a) TPL Bus 26.5 28.0 volts.
 - (5) Left Generator Reset and On, Right Generator Off.
 - (a) TPL Bus 26.5 28.0 volts.
 - (6) Right Generator Reset and On.

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	(7) GEN TIE Switch — NORM.
	(a) L and R GEN TIE OPEN Annunciators — Extinguished.
	(8) Generator Loadmeters — Observed Paralleled (Within 10%).
	d. Bus Sense Switch — Test.
	(1) L and R GEN TIE OPEN Annunciators — Illuminated.
	(2) BAT TIE OPEN Annunciator — Illuminated.
	(3) Voltages — Check.
	(a) R and L GEN Bus 27.5 - 29.0 volts.
	(b) TPL Bus: 26.5 - 28.0 volts.
	(c) CTR Bus — Zero volts.
	(4) Bus Sense Switch — Reset.
	(a) L and R GEN TIE OPEN Annunciators — Extinguished.
	(b) BAT TIE OPEN Annunciator — Extinguished.
ABC	3. Wing Flaps.
	a. Check flap actuation to APPROACH and DOWN.
	b. Verify that the position of the panel indicator matches the position selected by the flap handle.
ABC	4. Perform Before Taxi Checklist — refer to paragraph 7.2.5.
	9.8 TAXI
ABC	1. Taxiing.
	 a. No turning tendency shall exist while taxiing straight ahead with no braking and no rudder applied to either side. Check shall be made with minimum crosswind.
	b. Ground fine shall provide adequate drag to control taxi speed. Airplane will roll slowly at idle and will stop in ground fine.
	 Rudder pedal movement shall be free during turns using nose wheel steering and differential braking.
ABC	2. Perform Taxi Checklist, refer to paragraph 7.2.6.
	9.9 ENGINE RUN-UP AND BEFORE TAKEOFF
A	1. Altimeters.
	a. The pilots, copilots, and standby altimeters shall not vary more than 50 feet from the runway elevation when set to the tower-furnished altimeter setting. Record results below:
	Altimeter Pilot Copilot
	Runway Elevationftft
АВ	2. Engine Low Idle.
	a. Air Conditioner — Off.
	b. Bleed Air Valves — Open.

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	c. Envir Bleed Air	— Normal.		
	d. N ₁ : As required	to achieve 1,050 minimu	m RPM.	
	e. N ₂ : 1,050 RPM	minimum.		
	f. Record results be	elow.		
		Left	Right	
	N_1 :			
	N ₂ (>1,050):	R		RPM
	PROP PITCH An	nunciators		
	g. Verify L and R F	ROP PITCH Annunciato	ors illuminated.	
AB	3. Engine High Idle.			
	a. Check for accele	ration from low idle to hi	igh idle in approxim	ately 4 seconds.
	b. N ₁ : 70 - 72%. R	ecord results below.		
		Left		Right
	N ₁ (70 - 72%):	Leit	%	Kigiii %
	- (
AB	4. N ₁ Speed Switch —			
	a. Set Environment idle.	al Mode Switch to MAN	COOL with the rig	ght engine operating at low
	b. If the AIR CON advance condition		is illuminated on th	e lower annunciator panel,
	c. The AIR COND	N ₁ LOW Annunciator sh	all be extinguished	at N_1 speeds above 62%.
AB	5. Ground Idle Solenoi	d Dropout Switches.		
	a. Slowly increase solenoids.	power levers until elect	rical power is remo	oved from the ground idle
	b. Verify power is 1	removed at 68 - 70% N ₁ a	and:	
	(1) L and R PR	OP PITCH Annunciators	s extinguish.	
	(2) Propeller R	PM decreases.	-	
	` ´ -	rs are approximately align	ned.	
АВ		ght Idle Low-pitch Stops.		
		re Altitude — Record rea		
				DD16 1.150 1.250
		LE STOP — Set 1,500 RF		
			Kight KPM	
	Set 1,500 RPM		Pight ∩0/	
		etween engines for each		
	man A midue i	/ C . 11 C C C C C C C C C C C C C C C C	VIIVOR \1/U.	

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PROFILE		b. Propeller Levers — Full 1	forward.			
		c. Prop Test Switch — Hold		STOP.		
		d. Power Levers — Advance			00.	
		e. Prop Test Switch — Rele	•			
		(1) Verify prop RPM de) - 1,250.		
		f. Power Levers — Advance			00.	
g. Engine Torque — Record and compare to applicable graph on Figure 9-12. (1) Tolerance: ±2%.						re 9-12.
		h. Maximum Difference Bet	ween Left and I	Right Torques	<1%.	
		i. Power Levers — Idle.				
АВ	7.	Primary Governor.				
		a. Propeller Levers — Full 1	Forward.			
		b. Power Levers — Advance	e to Set Propelle	er RPM to 1,5	00.	
		c. Propeller Levers — Retar	rd to Detent.			
		(1) Verify left and right	RPM decrease t	together to 1,4	50 - 1,350 R	RPM.
		d. Propeller Levers — Retar	rd to Feather.			
		(1) Verify propellers star	rt to feather at 1	,400 - 1,350 F	RPM.	
		e. Record results below.				
		RPM at Detent	Left		Right	
		$N_2 (1,450 - 1,350)$	2011	RPM	ragin	RPM
		Start to feather at 1,400) - 1,350 RPM			
			Left	RPM	Right	RPM
AB	8.	Propeller Hydraulic Overspee	ed Governor.			
		a. Propeller Levers — Full to				
		b. Prop Test Switch — Hold				
		c. Power Levers — Advance 1,610 RPM.		ed governor is	controlling	propellers at 1
		d. Propeller Test Switch — 1	Release and not	e RPM increas	ses.	
		e. Power Levers — Idle.				
		f. Record results below.				
			T 0		P. 1.	
		N (1.520 1.610)	Left	D DN 4	Right	$\mathbf{D} \mathbf{D} \mathbf{M}$
		N ₂ (1,520 - 1,610)		RPM		RPM
A C	9.	Rudder Boost and Yaw Damp	ρ.			
		a. Rudder Boost Switch —	Off.			

(1) RUD BOOST OFF Annunciator — Illuminated.

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	b. Yaw Damp — Engage.
	(1) YD Annunciator illuminated on PFD.
	(2) Verify rudder pedal movement is stiff.
	c. Rudder Boost Switch — On.
	(1) RUD BOOST OFF Annunciator — Extinguished.
	d. Yaw Damp — Engage.
	e. Left Power Lever — Advance.
	(1) The left rudder pedal shall move forward as left torque continues to increase.
	(2) AP/YD DISC Switch (Each Control Wheel) — Press to First Level and Release.
	(a) Rudder boost shall be interrupted with switch held to first level.
	f. Left Power Lever — Idle.
	g. Yaw Damp — Engage.
	h. Repeat step f. by advancing the right power lever.
	i. Right Power Lever — Idle.
AB	10. Ground Fine.
	a. Propeller Levers — Full forward.
	b. Power Levers — Lift and move to ground fine detent.
	(1) N_1 Speed shall not change more than 0.5%.
	(2) N ₂ Speed shall increase approximately 40 RPM as blade angle decreases.
	(3) There shall be no perceptible forward or reverse thrust.
	c. Power Levers — Lift and move toward maximum reverse.
	(1) N_1 shall start to increase.
	d. Power Levers — Idle.
AB	11. Manual Feathering.
	a. Propeller Levers — Full forward.
	b. Condition Levers — Low idle.
	c. Propeller Levers — Individually pull to feather position.
	(1) Verify that there is a positive pedestal control detent.
	(2) Verify that propellers feather with no hesitation.
	(3) Verify that N_1 speed does not change more than 0.5%.
	d. Propeller Levers — Full forward.
AB	12. Engine Anti-Ice.
	a. Power Levers — Idle.
	b. Engine Anti-Ice Actuator Switches — Main.
	c. Engine Anti-Ice Switches — On.

(1) Green L and R ENG ANTI-ICE Annunciators — Illuminated.

- d. Left and Right MN ENG ANTI-ICE Circuit Breakers Pull.
 - (1) Amber L and R ENG ICE FAIL Annunciators Illuminated.
- e. Engine Anti-Ice Actuator Switches Standby.
 - (1) Amber L and R ENG ICE FAIL Annunciators Extinguished.
- f. Left and Right MN ENG ANTI-ICE Circuit Breakers Reset.
- g. Left and Right STBY ENG ANTI-ICE Circuit Breakers Pull.
 - (1) Amber L and Right ENG ICE FAIL Annunciators Illuminated.
- h. Engine Anti-Ice Actuator Switches Main.
 - (1) Amber L and R ENG ICE FAIL Annunciators Extinguished.
- i. Left and Right STBY ENG ANTI-ICE Circuit Breakers Reset.
- j. Engine Anti-Ice Actuator Switches Standby.
- k. Engine Anti-Ice Switches Off.
 - (1) Green L and R ENG ANTI-ICE Annunciators Extinguished.
- 13. Autofeather and Engine Auto-Ignition.
 - a. Both Condition Levers Low idle.
 - b. Auto Ignition Switches Arm.
 - (1) L and R IGNITION ON Annunciators Illuminated.
 - (2) L and R NO FUEL XFR Annunciators Illuminated after a short delay (if fuel is in Auxiliary Tanks).
 - c. Autofeather Switch Hold to Test.
 - (1) Green Left and Right AFX Annunciators Extinguished on PFD.
 - (2) AUTOFTHER OFF Annunciator Illuminated.

Note

If the ground idle solenoid dropout switches are activated during Step d., the GND IDLE STOP test switch will have to be held to the TEST position during the autofeather test described in Steps d. through h.

- d. Both Power Levers Set above 22% torque.
 - (1) Green Left and Right AFX Annunciators Illuminated on PFD.
 - (2) AUTOFTHER OFF Annunciators Extinguished.
 - (3) L and R IGNITION ON Annunciators Extinguished.
 - (4) L and R NO FUEL XFR Annunciators Extinguished.
- e. Left Power Lever Slowly retard to idle.
 - (1) At 20 14% Torque. Record results below.
 - (a) Right AFX Annunciator Extinguishes.
 - (b) L IGNITION ON Annunciator Illuminates simultaneously.
 - (c) AUTOFTHER OFF Annunciator Illuminates.

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- (d) L and R NO FUEL XFR Annunciators Illuminated after a short delay.
- (2) At 13 7% Torque. Record results below.
 - (a) Left AFX Annunciator Starts to blink.
 - (b) Left N₂ starts to oscillate as propeller attempts to feather.
- f. Left Power Lever Set above 22% Torque.
 - (1) Left and Right AFX Annunciators Illuminated.
 - (2) AUTOFTHER OFF Annunciator Extinguished.
 - (3) L and R IGNITION ON Annunciator Extinguished.
 - (4) L and R NO FUEL XFR Annunciators Extinguished.
- g. Repeat step e. by retarding the right power lever.
- h. Both power levers Set above 22% torque to arm system, then retard to idle.
 - (1) Autofeather System shall disarm.
 - (2) Neither propeller shall feather.
- i. Autofeather Switch ARM.
 - (1) AUTOFTHER OFF Annunciator Extinguished.
- j. Auto Ignition Switches OFF.
 - (1) L and R NO FUEL XFR Annunciators Extinguished.
 - (2) L and R IGNITION ON Annunciators Extinguished.
- k. Each Power Lever (With other power lever at idle) Advance to above 89% N₁.
 - (1) Verify that the system does not arm.
- 1. Each Power Lever (With other power lever >89% N₁) Advance until the Left and Right AFX Annunciators illuminate.
 - (1) The annunciators shall illuminate at 87 89% N₁. Record results below.
 - (2) N_1 values from each power lever test shall be within 2% N_1 of each other. Autofeather And Engine Auto Ignition:

Arm at >22% torque.

Disable at 20 - 14% torque.

Feather at 13 - 7% torque.

 N_1 to arm: 87 - 89%. (L and R arm within 2% N_1 .)

	Left	Right	
Disable			%
Feather Disable			%
Arm N ₁ Disable		%	%

- 14. Bleed Air Valves and Pressurization.
 - a. Environmental Bleed Air Switch NORMAL.

AB

- b. Condition Levers High idle.
- c. Left and Right Bleed Air Valves OPEN.
- d. Pressurization Controller Set 500 feet below field elevation.
- e. Pressurization Rate Knob Full clockwise.
- f. Cabin Pressure Switch Test.
 - (1) Verify indication of cabin pressurization within 15 seconds.
- g. Left and Right Bleed Air Valves Individually to PNEU & ENVIR OFF verify that:
 - (1) Cabin remains pressurized.
 - (2) L and R BLEED FAIL Annunciators remain extinguished.
 - (3) Appropriate BL AIR OFF Annunciator Illuminates.
 - (4) Pneumatic Pressure Gage indicates 12 20 psi.; Vacuum gage in green arc.
- h. Cabin Pressure Switch Release.
- i. Condition Levers Low idle.
- j. Left and Right Bleed Air Valves PNEU & ENVIR OFF.
 - (1) L and R BLEED FAIL Annunciators Illuminated.
 - (2) Pneumatic Pressure Gage 0.
 - (3) Gyro Suction Gage 0.
- k. Left and Right Bleed Air Valves OPEN.
- 1. Pressurization Controller and Rate Knob Set.
- m. Make sure that the cabin rate-of-climb gage indicates zero (adjust as required).
- n. Environmental Bleed Air Switch AUTO.

Brake Deice.

- a. Condition Levers High idle.
- b. Left Bleed Air Valve PNEU & ENVIR OFF.
- c. Brake Deice ON.
 - (1) R BK DEICE ON Annunciator Illuminated.
 - (2) Pneumatic Pressure and Gyro Suction Gages Verify decrease.
 - (3) Right ITT Verify small increase.
- d. Brake Deice OFF.
 - (1) R BK DEICE ON Annunciator Extinguished.
 - (2) Right ITT Verify small decrease.
- e. Left Bleed Air Valve OPEN.
- f. Right Bleed Air Valve PNEU & ENVIR OFF.
- g. Brake Deice ON.
 - (1) L BK DEICE ON Annunciator Illuminated.
 - (2) Pneumatic Pressure and Gyro Suction Gages Verify decrease.

AB

PROFILE	1
	(3) Left ITT — Verify small increase.
	h. Brake Deice — OFF.
	(1) L BK DEICE ON Annunciator — Extinguished.
	(2) Left ITT — Verify small decrease.
	i. Right Bleed Air Valve — OPEN.
	j. Condition Levers — Low idle.
АВ	16. Battery Ammeter.
	Make sure that the indicated value is zero to $+10$ amps before takeoff.
ABC	17. Perform Engine Runup Checklist, refer to paragraph 7.2.7.
ABC	18. Perform Before Takeoff Checklist, refer to paragraph 7.2.8.
ABC	19. Perform Lineup Checklist, refer to paragraph 7.2.9.
	9.10 DURING TAKEOFF
AB	1. Propeller RPM.
	a. Prop Sync — OFF.
	b. Propeller levers — Full forward.
	c. Propeller tachometers shall indicate 1,700 - 1,720 RPM. Record results below.
	L RPM R RPM
	d. With the propellers manually synchronized (minimal synchroscope movement), the propeller tachometers shall indicate within 10 RPM of each other.
АВ	2. Engine Instruments During Climb.
	a. All instruments shall give appropriate indication with minimum fluctuation.
	b. Maximum allowable oil pressure fluctuation is 10 psig.
АВ	3. Landing Gear.
	a. There shall be no excessive wheel vibration or shimmy during the takeoff roll.
	a. There shall be no excessive wheel vibration or shimmy during the takeoff roll.
ABC	a. There shall be no excessive wheel vibration or shimmy during the takeoff roll.b. Landing gear shall retract normally.
ABC ABC	a. There shall be no excessive wheel vibration or shimmy during the takeoff roll.b. Landing gear shall retract normally.c. There shall be no excessive wheel vibrations after gear retraction.
	 a. There shall be no excessive wheel vibration or shimmy during the takeoff roll. b. Landing gear shall retract normally. c. There shall be no excessive wheel vibrations after gear retraction. 4. Perform Climb Checklist, refer to paragraph 7.2.10.
	 a. There shall be no excessive wheel vibration or shimmy during the takeoff roll. b. Landing gear shall retract normally. c. There shall be no excessive wheel vibrations after gear retraction. 4. Perform Climb Checklist, refer to paragraph 7.2.10. 5. Perform Cruise Checklist, refer to paragraph 7.2.12.
ABC	 a. There shall be no excessive wheel vibration or shimmy during the takeoff roll. b. Landing gear shall retract normally. c. There shall be no excessive wheel vibrations after gear retraction. 4. Perform Climb Checklist, refer to paragraph 7.2.10. 5. Perform Cruise Checklist, refer to paragraph 7.2.12. 9.11 IN-FLIGHT INSPECTIONS
ABC	 a. There shall be no excessive wheel vibration or shimmy during the takeoff roll. b. Landing gear shall retract normally. c. There shall be no excessive wheel vibrations after gear retraction. 4. Perform Climb Checklist, refer to paragraph 7.2.10. 5. Perform Cruise Checklist, refer to paragraph 7.2.12. 9.11 IN-FLIGHT INSPECTIONS 1. Brake Deice.
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ABC	 a. There shall be no excessive wheel vibration or shimmy during the takeoff roll. b. Landing gear shall retract normally. c. There shall be no excessive wheel vibrations after gear retraction. 4. Perform Climb Checklist, refer to paragraph 7.2.10. 5. Perform Cruise Checklist, refer to paragraph 7.2.12. 9.11 IN-FLIGHT INSPECTIONS 1. Brake Deice. a. IOAT: 15 °C or Below. b. Brake Deice Switch — On.

PROFILE	
	15 °C or below 8 - 12 minute cycle Min.
	(1) Left or Right ITT — Verify small decrease.
	d. Brake Deice Switch — Off, then on.
	(1) Verify that brake deice system does not turn on.
	e. Landing Gear — Down.
	(1) Verify that brake deice system turns on.
	f. Brake Deice Switch — Off.
	(1) L and R BK DEICE ON Annunciators — Extinguished.
	g. Landing Gear — Retract.
AB	2. Propeller Sychrophaser.
	a. Propeller Synchrophaser — OFF.
	 b. Propeller Levers — Establish a small Out-Of-Sync condition by decreasing the Lef propeller RPM.
	c. Propeller Synchrophaser — On.
	 Synchronization and synchrophasing shall be established and held within a few seconds.
	d. Propeller Synchrophaser — Off.
	e. Propeller Levers — establish a small Out-Of-Sync condition by increasing the Lef Propeller RPM.
	f. Propeller Synchrophaser — On.
	 Synchronization and synchrophasing shall be established and held within a few seconds.
A	3. Vertical Speed.
	a. Establish a Rate-Of-Climb of 1,000 fpm.
	b. Determine change in altitude during a 1-minute climb.
	c. The change in altitude shall be 800 - 1,200 feet.
Α	4. Pilot's Alternate Static Air.
	a. Autopilot — Engage and select Altitude Hold.
	b. Pilot's Static Air Source — Alternate.
	(1) The pilot's altimeter, airspeed, and rate-of-climb indications shall increase.
	(2) The autopilot shall descend the airplane to its original altitude.
	c. Pilot's Static Air Source — Normal.
	(1) The pilot's altimeter, airspeed, and rate-of-climb indications shall decrease.
	(2) The autopilot shall climb the airplane back to its original altitude.
Α	5. Normal Landing Gear Operation.
	a. Landing gear shall extend in 7 seconds or less at 182 KIAS. Record time below. Extend @ 182 KIAS (7 Seconds Max):seconds.

b. Landing gear shall retract in 8 seconds or less at 164 KIAS. Record time below. Retract @ 164 KIAS (8 Seconds Max):	PROFILE	
c. Upper and lower red lights in handle shall illuminate when gear is in transit. d. Lights shall be extinguished when gear is up or down and locked. e. Green NOSE, I., and R. Annunciators shall illuminate when gear is down and locked and extinguished when gear is retracted. 6. Flap Operation. a. Airspeed — 202 KIAS. b. Flaps — Lower to APPROACH, Then retract to UP. (1) Rolling Tendency — Minimal. c. Airspeed — 158 KIAS. d. Flaps — Lower to DOWN, Then retract to UP. (1) Rolling Tendency — Minimal. (2) Extension Time — 15 Seconds Maximum. Record time below. (3) Retraction Time — 9 Seconds Maximum. Record time below. Flap Operation: 202 KIAS: UP-APPROACH-UP — Check rolling. 158 KIAS: UP-DOWN-UP — Check rolling and time. Down (15 Seconds Max): seconds. Up (9 Seconds Max): seconds. Up (9 Seconds Max): seconds. A irspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Extension. a. Airspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Relay circuit breaker on pilots right subpanel. c. Landing gear control — DN. d. Unstow the Alternate Extension handle and pump until resistance lessens, about 1-4 pumps. e. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		b. Landing gear shall retract in 8 seconds or less at 164 KIAS. Record time below.
d. Lights shall be extinguished when gear is up or down and locked. e. Green NOSE, L, and R Annunciators shall illuminate when gear is down and locked and extinguished when gear is retracted. 6. Flap Operation. a. Airspeed — 202 KIAS. b. Flaps — Lower to APPROACH, Then retract to UP. (1) Rolling Tendency — Minimal. c. Airspeed — 158 KIAS. d. Flaps — Lower to DOWN, Then retract to UP. (1) Rolling Tendency — Minimal. (2) Extension Time — 15 Seconds Maximum. Record time below. (3) Retraction Time — 9 Seconds Maximum. Record time below. Flap Operation: 202 KIAS: UP-APPROACH-UP — Check rolling. 158 KIAS: UP-DOWN-UP — Check rolling and time. Down (15 Seconds Max): seconds. Up (9 Seconds Max): seconds. A irspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Extension. a. Airspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Relay circuit breaker on pilots right subpanel. c. Landing gear control — DN. d. Unstow the Alternate Extension handle and pump until resistance lessens, about 1-4 pumps. e. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down amnunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		Retract @ 164 KIAS (8 Seconds Max):seconds.
c. Green NOSE, I., and R Annunciators shall illuminate when gear is down and locked and extinguished when gear is retracted. 6. Flap Operation. a. Airspeed — 202 KIAS. b. Flaps — Lower to APPROACH, Then retract to UP. (1) Rolling Tendency — Minimal. c. Airspeed — 158 KIAS. d. Flaps — Lower to DOWN, Then retract to UP. (1) Rolling Tendency — Minimal. (2) Extension Time — 15 Seconds Maximum. Record time below. (3) Retraction Time — 9 Seconds Maximum. Record time below. Flap Operation: 202 KIAS: UP-APPROACH-UP — Check rolling. 158 KIAS: UP-DOWN-UP — Check rolling. 158 KIAS: UP-DOWN-UP — Check rolling. Opom (15 Seconds Max): seconds. Up (9 Seconds Max): seconds. 7. Manual Landing Gear Extension. a. Airspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Relay circuit breaker on pilots right subpanel. c. Landing gear control — DN. d. Unstow the Alternate Extension handle and pump until resistance lessens, about 1-4 pumps. e. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		c. Upper and lower red lights in handle shall illuminate when gear is in transit.
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(1) Rolling Tendency — Minimal. c. Airspeed — 158 KIAS. d. Flaps — Lower to DOWN, Then retract to UP. (1) Rolling Tendency — Minimal. (2) Extension Time — 15 Seconds Maximum. Record time below. (3) Retraction Time — 9 Seconds Maximum. Record time below. Flap Operation: 202 KIAS: UP-APPROACH-UP — Check rolling. 158 KIAS: UP-DOWN-UP — Check rolling and time. Down (15 Seconds Max): seconds. Up (9 Seconds Max): seconds. 4. A irspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Extension. a. Airspeed approximately, but not to exceed 182 KIAS. b. Pull Landing Gear Relay circuit breaker on pilots right subpanel. c. Landing gear control — DN. d. Unstow the Alternate Extension handle and pump until resistance lessens, about 1-4 pumps. c. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		a. Airspeed — 202 KIAS.
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c. Landing gear control — DN. d. Unstow the Alternate Extension handle and pump until resistance lessens, about 1-4 pumps. e. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		a. Airspeed approximately, but not to exceed 182 KIAS.
 d. Unstow the Alternate Extension handle and pump until resistance lessens, about 1-4 pumps. e. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required. 		b. Pull Landing Gear Relay circuit breaker on pilots right subpanel.
pumps. e. If desired, allow the gear to free fall as much as possible before resuming pumping. f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		c. Landing gear control — DN.
f. Lower the landing gear by pumping the handle up and down. (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		
 (1) Do not lower the handle all the way to the floor during the down stroke. (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required. 		e. If desired, allow the gear to free fall as much as possible before resuming pumping.
 (2) When all 3 green Gear-Down annunciators are illuminated and increased resistance is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. A C 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required. 		f. Lower the landing gear by pumping the handle up and down.
is felt, stow the extension handle. g. To raise the gear, reset the Landing Gear Relay circuit breaker and raise the landing gear control. 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		(1) Do not lower the handle all the way to the floor during the down stroke.
control. 8. Stall Warning Check. a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required.		
 a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in. b. Yaw damper — As required. 		
b. Yaw damper — As required.	A C	8. Stall Warning Check.
		a. Weight and balance — 12,600 - 13,000 lbs @ FS 197.3 - 200.4 in.
FLAPS UP Check:		b. Yaw damper — As required.
		FLAPS UP Check:

- c. Configuration Flaps and gear up.
- d. Propellers 1,500 rpm.
- e. Torque 10%.
- f. Maintain initial heading and altitude.
- g. Allow aircraft to slow at 1 knot/second or less until stall warning horn sounds, buffet onset is reached, or 3 kts knots below expected stall warning speed.

Note

If 3 knots less than expected stall warning speed reached without buffet or stall warning horn, do not continue to slow. Discontinue the check and recover.

- h. Low Speed Cue indication Verify.
- i. Stall Warning Speed Record.
- j. Once Stall Warning Speed reached Advance power and adjust pitch attitude to maintain altitude.
- k. At 140 KIAS Reset cruise power.

FLAPS DOWN Check:

- 1. Torque 30%.
- m. Maintain initial heading and altitude.
- n. Flaps APPROACH.
- o. Gear DN.
- p. Flaps DOWN.
- q. Propellers 1,700 rpm.
- r. Torque 10%.
- s. Allow aircraft to slow at 1 knot/second or less until stall warning horn sounds, buffet onset is reached, or 3 knots below expected stall warning speed.

Note

If 3 knots less than expected stall warning speed reached without buffet or stall warning horn, do not continue to slow. Discontinue the check and recover.

- t. Low Speed Cue indication Verify.
- u. Stall Warning Speed Record.
- v. Advance power and adjust pitch attitude to stop buffeting.
- w. Establish positive rate of climb.
- x. Flaps APPROACH (at or above V_{REF} +10 knots).
 - (1) Gear UP.
 - (2) Flaps UP (at or above VYSE).
- y. Reset Cruise Power.

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Figure 9-2. Heavyweight Aircraft With or Without ER Fuel Tanks Installed

Configuration	Power	Trim Speed	Stall Speed	Stall Warning	Low Speed Cue
Gear & Flaps Up	ldle	138	89-95	V _s +(5 to 15)	99
Gear Up & Flaps Approach	Idle	125	80-86	V _S +(5 to 15)	91
Gear & Flaps Dn	Idle	113	73-78	V _S +(5 to 15)	82

9. Stalls and Stall Warnings Check.

Note

- This check is only required and shall only be flown following the removal and reinstallation of one or both wings, in order to verify rigging.
- This check supersedes the step 8. Stall Warning Check. The step 8. Stall Warning Check may be omitted from the FCF when the complete step 9. Stalls and Stall Warnings Check is conducted.
- Due the risk involved, this check shall not be flown unless specifically required by PMA-207. Additionally, squadron designated FCF Pilots are not authorized to perform this check.

Conduct stalls up to the point where the elevator control reaches the full aft stop using the following procedure:

- a. Weight and balance 12,600 13,000 lbs @ FS 197.3 200.4 in.
- b. Propeller Levers Full Forward.
- c. Condition Levers Low Idle.
- d. Prop Sync Off.
- e. Configuration—Set (During configuration changes monitor the stall red line, and ensure a smooth transition between speeds as the flaps extend and retract.)
- f. Trim Speed Set.
- g. Airspeed Reduce at 1 knot/second or less.
- h. Low Speed Cue indication Verify.
- i. Stall Warning Speed Record.
- j. Roll and Yaw Attitude up to the Point of Stall Controllable within 15°.
- k. Stall Speed Record. _____
- 1. Recovery Roll and Yaw controllable within 15°.

Figure 9-3. Heavyweight Aircraft With or Without ER Fuel Tanks Installed

Configuration	Power	Trim Speed	Stall Speed	Stall Warning	Low Speed Cue
Gear & Flaps Up	Idle	138	89-95	V _S +(5 to 15)	99
Gear & Flaps Up	1,700 RPM 50% Torque	138	As observed	*	99
Gear Up & Flaps Approach	Idle	125	80-86	V _S +(5 to 15)	91
Gear Up & Flaps Approach	1,700 RPM 50% Torque	125	As observed	*	91
Gear & Flaps Dn	Idle	113	73-78	V _S +(5 to 15)	82
Gear & Flaps Dn	1,700 RPM 50% Torque	113	As observed	*	82

^{*} An absolute speed no greater than the corresponding Power – Idle Stall Warning Speed, and at least 5 KIAS above the Power – On Stall Speed.

- 10. Ground Low-Pitch Power—Lever Switch.
 - a. Propeller Levers Full forward.
 - b. Power Levers Flight idle.
 - c. Airspeed Slow until N₂ starts to decrease.
 - d. Power Levers Lift (Do Not Retard).
 - (1) Observe an increase in Propeller Drag.
 - (2) N₂ shall increase.
 - e. Power Levers Lower to flight idle.
 - (1) Observe a decrease in Propeller Drag.
 - (2) N₂ shall decrease.
- 11. Manual Propeller Feather and Unfeather.

Check feathering on each engine in turn using the procedures below. Keep slip/skid ball centered during test.

- a. Gear and Flaps Up.
- b. Airspeed 140 KIAS.
- c. Autofeather Off.
- d. Propeller Levers 1,700 RPM.
- e. Power Lever Idle.
- f. Condition Lever (Appropriate Side) Fuel Cutoff.
- g. Propeller Lever (After N₁ decreases below 20%) Feather.
- h. Record the time to feather below, defined as the elapsed time from the moment the Propeller Lever is moved into the FEATHER position until rotation has stopped. The time to feather shall not exceed 10 seconds.

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	Manual Propeller Feather and Unfeather: Feather @140 KIAS with N_1 <20%. 10 seconds maximum to no rotation.
	Left:sec. Right:sec.
	Flaps up 140 KIAS, unfeather — 1,000 RPM within 20 Sec.
	Left:sec. Right:sec.
i.	Restart the engine with the propeller in the FEATHERED position.
	(1) ECS Mode — OFF.
	(2) Cockpit/Cabin Blower — Auto.
	(3) Bleed Air Valve (Inop Engine) — ENVIR OFF.
	(4) Radar — Standby or OFF.
	(5) Furnishings — OFF.
	(6) Power Levers — Idle.
	(7) Prop Levers — Low RPM.
	(8) Condition Lever — Fuel Cutoff.
	(9) Firewall Fuel Valve — Open [Extinguisher Push] and [Closed] Extinguished.
	(10) Ignition and Engine Start — On [Ignition On] — Illuminated.
	CAUTION
	If conditions permit, retard operative engine ITT to 700 °C or

If conditions permit, retard operative engine ITT to 700 °C or less to reduce the possibility of exceeding ITT limit. Reduce electrical load to minimum consistent with flight conditions.

- (11) Condition Lever (10% N_1 or above) Low Idle.
- (12) ITT and N₁ Monitor (1,000 °C Maximum).
- (13) Ignition and Engine Start (N_1 above 50%) OFF.
- (14) Prop Lever As required.
- (15) Power Levers As required.
- (16) Generators Reset, then on.
- (17) Engine Auto Ignition As required.
- (18) Electrical Equipment As required.
- (19) Cockpit/Cabin Blower Auto.
- (20) Bleed Air Valve Open.
- (21) ECS Mode AUTO.
- j. With the condition lever at low idle and the power lever at idle, move the propeller lever out of the feather detent to full forward.
- k. The propeller speed shall reach 1,000 RPM within 20 seconds.
 - (1) Retard propeller lever as required to prevent RPM surge.
- 12. Propeller Autofeather.

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PROFILE Check Autofeather on each engine in turn using the procedures below. Slip/skid Indicator — Centered during test. b. Autofeather — Arm. c. Power — 1,700 RPM and Torque as required to arm the autofeather system. d. Airspeed — 160 KIAS. e. Condition Lever — Cutoff and Start Time. Maintain 160 KIAS. f. Record time from cutoff to feathered propeller below. (1) Propeller is considered feathered when the blades are individually visible to the human eye and the propeller is still rotating. (2) The time to autofeather shall not exceed 10 seconds. Left: sec. Right: ____sec. No rotation @111 KIAS. g. Restart engine using starter assist procedures listed in step 11.i. h. Repeat steps a. through g. on other engine. AB 13. Generators. a. L GEN and R GEN Bus Voltage: 27.5 - 29.0 volts (within 1 volt of each other). b. Left and Right Loadmeters: (1) Parallel operation Within 10%. (2) Load commensurate with operating equipment. c. Record results below. Generators: Left Right 27.5 - 29.0 volts volts volts % Loads Parallel within 10% AB 14. Windshield Anti-Ice. a. Pilots Windshield Anti-Ice Switch — HI. Note increase in loadmeter. b. Pilots Windshield Anti-Ice Switch — OFF. Note decrease in loadmeter. c. Pilots Windshield Anti-Ice Switch — NORMAL. Note increase in loadmeter. d. Repeat steps a. through c. using the copilots windshield anti-ice switch. 15. Audio System. a. Cabin Pager System — Check pilot and copilot sides. (1) Check volume control on audio panel. b. Cockpit Speakers — Check function and volume control on pilot and copilot sides. c. Pilots and Copilots Headsets — Check function and volume control. d. Pilots and Copilots Hand Mics — Check function. e. Hot Interphone — Check function. f. Check NAV 1 and NAV 2 voice and range aural signals on pilot and copilot sides.

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- g. Check DME 1, DME 2, and ADF aural signals on pilot and copilot sides.
- 16. Cabin Ventilation.
 - a. Cockpit and Cabin Eyeballs Check freedom of movement and air flow.
 - b. Cabin Floor Outlets Verify adequate air flow.

17. Pressurization.

- a. Take-off and climb to 12,500 feet (Rate knob check and 5,000 feet cabin altitude check).
 - (1) Set controller for a 5,000 feet cabin altitude and rate knob at 1:00 to 3:00.
 - (2) Environmental Bleed Air Normal.
 - (3) After lift-off, monitor cabin pressurization for a smooth transition.
 - (4) Check rate knob for proper rate-of-climb. Record results below.
 - (a) Rate knob @ minimum = zero 300 fpm cabin rate-of-climb.
 - (b) Rate knob @ 12:00 = 350 650 fpm cabin rate-of-climb.
 - (c) Rate knob @ maximum = 1,500 3,000 fpm cabin rate-of-climb.
 - (5) Verify that cabin altitude stabilizes at 4,600 5,400 feet. Record results below.
 - (6) Reset controller for an 11,000 feet cabin altitude.
- b. Cabin Altitude Transducers.
 - (1) Verify white CABIN ALTITUDE Annunciator illuminates at 10,000 10,500 feet cabin altitude and warning tone sounds. Record results below.
 - (2) Cancel the warning tone.
 - (3) Place Cabin Press Switch to the DUMP position.
 - (4) Verify that the red CABIN ALT HI Annunciator illuminates between 11,000 12,000 feet cabin altitude and the warning tone sounds again. Record results below.
 - (5) Cancel the warning tone.
 - (6) Verify that the following events occur at 12,000 13,000 feet cabin altitude (Turn Bleed Valves OFF if secondary controller activates). Record altitude below.
 - (a) Cabin Oxygen Masks Deploy.
 - (b) Cabin Indirect Lights Illuminate.
 - (c) NO SMOKING and FASTEN SEAT BELT and associated chimes sound.
 - (d) The PASS OXY ON Annunciator Illuminates.
- c. Continue climb and verify that the cabin altitude is limited to 12,000 15,000 feet by the secondary controller.
- d. Climb to 15,500 feet (Rate Knob, Max ΔP , Leak Rate, Min. N_1).
 - (1) Place Cabin Press Switch to the PRESS position.
 - (2) Reset controller for a SL cabin altitude.
 - (3) Check rate knob for proper rate-of descent. Record results below.
 - (a) Rate knob @ minimum = zero 300 fpm cabin rate-of-descent.
 - (b) Rate knob @ 12:00 = 350 650 fpm cabin rate-of-descent.

- (c) Rate knob @ maximum = 1,500 3,000 fpm cabin rate-of-descent.
- (4) Verify Max ΔP of 6.4 6.6 is obtained at approximately 15,300 feet pressure altitude. Record results below.
- (5) At Max ΔP , check cabin leak rate.
 - (a) Place both bleed air valves to ENVIR OFF.
 - (b) When cabin ΔP reaches 5.9, the cabin rate-of-climb shall not exceed 2,200 fpm. Record results below.
 - (c) Place both Bleed Air Valves to OPEN and re-establish Max ΔP .
- (6) At Max ΔP , verify that each engine shall maintain pressurization at idle power. Record results below.
 - (a) Place left Bleed Air Valve to ENVIR OFF.
 - (b) Retard right power lever to idle.
 - (c) After pressurization has stabilized, verify that cabin R/C is zero and ΔP is approximately maximum.
 - (d) Repeat procedure for left engine. (Left Bleed Air Valve OPEN, Right Bleed Air Valve ENVIR OFF, and left engine at idle.)
 - (e) Right Bleed Air Valve OPEN.
 - (f) Reset controller for 500 feet above field elevation.
 - (g) Place the Environmental Bleed Air Switch to LOW.
 - (h) Verify that the two-engine minimum N₁ speed to maintain pressurization does not exceed idle.

After takeoff, cabin altitude stable at:

(4,600 - 5,400) feet):	_ feet P.A.	
CABIN ALT	TTUDE (10 - 10.5k)	feet.	
CABIN ALT	HI (11 - 12k)	feet.	
@ 12,000 - 1	3,000 feet:	feet.	
Cabin indirection No Smoking	eploy (PASS OXY ON). et lights ON. /FSB sign ON. ontroller: Limits cabin to	o 12 - 15k.	
Max ΔP (6.4	1 - 6.6):		psid.
Leak Rate @	5.9 psid. (2,200 fpm):		fpm.
Min. N ₁ for	pressurization is Idle:		
L:	% N ₁	R	% N

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Bleed Air Switch Low. Maintain pressure with both engines at idle.

Knob Setting	Climb Rate	Descent Rate
Minimum (0 - 300)	fpm	fpm
12:00 (350 - 650)	fpm	fpm
Maximum (1,500 - 3,000)	fpm	fpm

e. Test is complete. Return controller to desired setting and the Environmental Bleed Air Switch to AUTO.

18. Oxygen.

After passenger masks have been automatically deployed during the checks of the pressurization system:

- a. Verify the PASS OXY ON Annunciator is illuminated.
- b. Check for oxygen flow from crew masks and passenger masks.
- c. Verify that the microphone in the crew oxygen masks functions by placing the pilots and copilots Mic switches to the Oxygen Mask position and making a transmission.
- d. Make sure that the Passenger Manual Drop-Out handle is pushed in. Pull the OXY CONTROL circuit breaker and verify that oxygen flow to the passenger masks stops.
- e. Reset the circuit breaker.
- f. After cabin has been repressurized sufficiently to extinguish the PASS OXY ON Annunciator, pull the Passenger Manual Drop-Out handle and verify that the annunciator re-illuminates along with the cabin indirect lights, No Smoking and Fasten Seat Belts signs and the associated chimes.
- g. Push in the Passenger Manual Drop-Out handle and verify that the annunciator extinguishes.
- 19. Engine Acceptance at Maximum Continuous Power.
 - a. Establish level flight at 16,000 feet pressure altitude and 1,700 RPM.
 - b. Adjust the non-test engine to maintain 160 KIAS.
 - c. Set the test engine torque as specified in Figure 9-4 for the observed IOAT.
 - d. After a 3-minute stabilization period, record the IOAT and test engine data in Figure 9-4. If the observed ITT exceeds the table value, inform maintenance at completion of flight.
 - e. Repeat the above procedure for the opposite engine.
- 20. Perform Climb Transition Checklist, refer to paragraph 7.2.11.
- 21. Speed Performance at Maximum Cruise Power.

Note

Perform this procedure at 16,000 feet and 26,000 feet only if the engine is new; otherwise this check is accomplished at 26,000 feet.

For those engines which exceed the allowable ITT or fuel flow values during the 26,000 feet check, an engine acceptance check at maximum cruise power shall be conducted in accordance with paragraph 9.11, step 25., compliance therewith constitutes meeting the ITT and fuel flow requirements of this paragraph.

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Note

Perform Engine Anti-Ice Check, step 22., in conjunction with this check.

- a. Test conditions:
 - (1) Weight CG 12,600 13,000 pounds @ F.S. 197.3 200.4.
 - (2) Smooth air.
 - (3) Bleed Air Valves Open.
 - (4) Environmental Bleed Air Normal.
 - (5) Engine Anti-Ice OFF.
- b. With ER Fuel Tanks installed, record data in Figures 9-7 or 9-8.
- c. Without ER Fuel Tank, record data in Figures 9-9 or 9-10.
- d. Altitude $16,000 \pm 100$ feet (first flight) and $26,000 \pm 100$ feet.
- e. Propeller Levers 1,500 RPM.
- f. IOAT Note.
- g. Power Levers Set torque in accordance with Figures 9-7 or 9-8 as appropriate.
- h. IOAT Record after airspeed has stabilized for 3 minutes.
- i. Power Levers Reset in accordance with Figures 9-7, or 9-8 as appropriate for the IOAT.
- j. Airspeed Record when stable for 3 minutes.
 - (1) Pilot's vs Table Table value or above.
- k. Fuel flows: -30 to +10 pph of values in tables.

Note

Table values for fuel flow are representative only, and non-compliance is not a criterion for engine rejection, although it may indicate a problem with bleed air, electrical load, or the air conditioner.

- 1. ITT Table value or less (left and right engine within 20 degrees of each other).
- 22. Engine Anti-Ice.

Conduct this check during the paragraph 9.11, step 21., Speed Performance At Maximum Cruise Power.

- a. Engine Anti-Ice Actuator Switches Main.
- b. Engine Anti-Ice Switches ON.
 - (1) L and R ENG ANTI-ICE Annunciators Illuminated.
 - (2) Left and Right Torque Shall decrease approximately 10 15%. Record results below.

Torque Drop: L = % R = %

- 10 15% drop, L and R within 2% Torque.
- (a) Difference between L and R torque shall be $\leq 2\%$.
- (3) Left and Right Engine ITTs shall increase.

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		c. Engine Anti-Ice Switche	es — Off.		
		(1) L and R ENG ANT	ΓΙ-ICE Annunciators	s — Extinguished.	
		(2) Left and Right Toro	que and ITT — Sha	ll return to original	values.
ABC	23.	. Trim and Rigging.			
		 a. Make sure that the air indicator is centered. 	plane is trimmed l	aterally and directi	onally and the slip/skid
		b. The inboard edge of the the outboard edge of the			
		c. Make sure that the ailer bendable aileron trim ta		icates approximately	y zero units. (Adjust the
		d. Make sure control whee	els are level.		
АВ	24.	. Maximum ITT/N ₁ Availabil	lity.		
		a. Altitude — 26,000 feet.			
		b. Prop Controls — Full F	orward.		
		c. Verify that sufficient powof 104%.	wer lever travel is av	vailable to produce a	n ITT of 820 °C or an N_1
		d. Record results in Figure	e 9-6.		
АВ	25.	. Engine Acceptance at Maximum paragraph 9.11, step 21., at			TT limit of
		a. Establish level flight at	26,000 feet pressure	altitude at 1,500 R	PM.
		b. Adjust the non-test engi	ne to maintain 160	KIAS.	
		c. Set the test engine torqu	e as specified in Fig	gure 9-5 for the obse	erved IOAT.
		d. After a 3-minute stabilized below. If the observed I flight.			test engine data in chart tenance at completion of
		e. Repeat the above proceed	dure for the opposite	e engine.	
AB	26.	. Airspeed Indicator Agreeme	ent.		
		The pilot, copilot, and stand low, medium, and high airs below.			
			Low	Medium	High
		Pilot			
		Copilot			_
		Standby			
			(Indicator agre	ement within 4 KL	AS)

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27. Altimeter Indicator Agreement.

The pilot, copilot, and standby altimeters will agree within 50 feet of each other. Checks will be conducted at 16,000 and 25,000 feet. Record results below.

	Pilot	Copilot	Standby
Alt (16K)			
Alt (25K)			

28. Vacuum System.

- a. Set normal cruise power.
- b. Turn the Left Bleed Air Valve to PNEU & ENVIR OFF.
 - (1) From SL to 15,000 feet, the gyro suction gage shall indicate 5.9 to 4.3 in. Hg.
 - (2) Between 15,000 feet and 35,000 feet, it shall indicate 5.9 to 2.8 in. Hg.
 - (3) The lower the altitude, the higher the gage indication shall be. Record results below.
- c. Repeat step b. with the Left Bleed Air Valve OPEN and the Right Bleed Air Valve to PNEU & ENVIR OFF.
- d. Return the Right Bleed Air Valve to OPEN.

Left:	in. Hg. Right:	_in. F	łg
P.A.:			

- 29. Yaw Damp.
 - a. Yaw Damp Engage.
 - (1) Verify that the rudder pedals do not kick and heading does not change.
 - (2) Verify proper annunciation.
 - b. Conduct Left and Right 30° banked turns.
 - (1) The slip/skid indicator shall remain within the cage lines without rudder input from the pilot.
 - c. Evaluate damping capability by inputting a rudder doublet.
 - (1) The nose shall return to coordinated flight when doublet is removed with no overshoot.
 - d. The first level of the quick disconnect switch shall disconnect the yaw damper. Check pilot and copilot sides.
- 30. Attitude Indicators.

Verify that the pilot, copilot, and standby attitude indicators provide correct display of pitch and roll during maneuvering flight.

- 31. HF Communications.
 - a. Verify adequate transmissions and receptions with Houston or New York Radio. Check LO and HI transmission power. Receptions will be clear without excessive static or "motor boating" sounds.
 - b. Select the ADF bearing pointer and tune an ADF station.
 - c. Transmit on the HF radio (such as EMC test frequency 4.5215 MHz) and verify that the bearing pointer position freezes.

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- 32. Landing Gear Warning Horn.
 - a. Gear and Flaps Retracted.
 - b. Each Power Lever in Turn Retard below 84% N₁.
 - (1) The warning horn shall sound and the red lights in the handle shall illuminate at 84 86% N₁. Record results below.
 - (2) GEAR WARN SILENCE Button (on left power lever) Push to silence horn.

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N_1: L % N_1: R %
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Silence Button.

Check horn at Approach flaps and silence button.

Check horn at Full flaps and silence button inop.

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- 33. Fuel Transfer.
 - a. Determine that fuel transfer is operating correctly by monitoring AUX and, if ER tanks are installed, ER fuel levels.

9.12 INFLIGHT NAVIGATION AND FLIGHT GUIDANCE

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ABC

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- 1. Perform Descent Checklist at appropriate time, refer to paragraph 7.2.13.
- 2. Perform Descent Transition Checklist at appropriate time, refer to paragraph 7.2.14.
- 3. Perform Approach Checklist at appropriate time, refer to paragraph 7.2.15.
- 4. Flight Guidance System.
 - a. Verify the operation of the SYNC button located on each control wheel.
 - b. Verify the operation of the GA button located on the left thrust lever.
 - c. Verify the operation of the AP DISENG button located on each control wheel.
 - d. Verify that the aural alert sounds when the autopilot is disengaged.
 - e. Verify that the aural alert sounds and that the preselected altitude value flashes when the airplane is within 1,000 feet of the preselected altitude, and that the preselected altitude display ceases flashing when within 200 feet of selected altitude.
 - f. Verify proper operation of each basic autopilot mode, Flight Director mode, and control on the Flight Guidance Panel (FGP):
 - (1) AP Button Engages/disengages autopilot.
 - (2) FD Button Selects/deselects the on-side flight director.
 - (3) HDG Button Selects/deselects the heading select mode.
 - (4) HDG Knob Controls the heading bug on the PFDs. Pushing the center of the knob slews the heading bug to the airplanes present heading.
 - (5) NAV Button Selects/deselects the navigation mode.
 - (6) CRS1 Knob Sets the course guidance needle when VOR is the active navigation source selected on the pilots PFD. Pushing the center of the knob slews the course guidance needle directly to the tuned navaid.
 - (7) CRS2 Knob Sets the course guidance needle when VOR is the active navigation source selected on the copilots PFD. Pushing the center of the knob slews the course guidance needle directly to the tuned navaid.

- (8) APPR Button Selects/deselects approach mode.
- (9) VS Button Selects/deselects vertical speed mode. Selection is inhibited during approach mode capture/track or overspeed mode.
- (10) VS/Pitch Wheel Rotation up or down slews the vertical speed reference displayed on the PFD in the direction of the wheel rotation.
- (11) FLC Button Selects/deselects the flight level change mode. Upon mode selection, the reference IAS/MACH is set to the current displayed value on the PFD.
- (12) VNAV Button Selects/deselects vertical navigation mode. Selection is inhibited when vertical capture/track state is active or when overspeed mode is active.
- (13) SPEED Knob Sets the reference IASA/MACH displayed on the PFD. Pushing the center of the knob switches between IAS and MACH.
- (14) ALT Button Selects/deselects the altitude hold mode.
- (15) ALT Knob Sets the preselected altitude for capture/hold displayed on the PFD. Pushing the center of the knob cancels the altitude preselect alert.
- (16) YD Button Selects yaw damper engagement (independently of the autopilot). The yaw damper is automatically engaged when the autopilot is engaged. Disengaging the yaw damper with this button shall also disengage the autopilot.
- (17) 1/2 Bank Button Selects/deselects half-bank mode, which reduces the maximum commanded bank angle to 15°. Half-bank is automatically selected when climbing through and deselected when descending through FL 185. Half-bank is automatically deselected upon NAV capture of localizer, approach mode capture, or when go-around mode is selected.
- (18) AP/YD DISC Bar Disconnects autopilot and yaw damper.
- (19) CPL Button Transfer control of autopilot between pilot and copilot and deselect NAV mode and selects HDG mode.
- (20) SYNC Button Synchronizes the compatible vertical and lateral references to those being flown when the autopilot is not engaged.
- (21) GA Button Deselects the autopilot, selects 7° pitch-up and roll commands on the flight director. The yaw damper remains engaged. Selection is inhibited when altitude preselect mode is active, and when overspeed mode active.
- (22) AP DISENGAGE (C/B Deselects the AP autopilot and yaw damper).
- 5. Radio Altimeter.
 - a. Check for proper function.
- 6. Marker Beacon.

Check following items on the pilot and copilot sides.

- a. Check volume control for Marker Beacon 1 and 2.
- b. Check sensitivity on HI. After initial tone is heard, select LO. Tone shall cease and then resume.
- c. Check OM and MM Annunciations and associated Morse Code.

7. ILS.

a. If approach is being flown using FMS guidance, verify autotuning of appropriate ILS frequency.

AΒ

AB

AΒ

PROFILE	•					
		b. Verify minimal	glide path and localiz	er needle oscillations	from OM to end of runwa	ıy.
		c. Flight Director control activity		ck localizer and glide	slope without excessive fl	light
		d. Manually defle path.	ct airplane from appro-	ach path and verify the	at autopilot recaptures des	sired
АВ	8.	GPS Approach.				
АВ	9.	TAWS+.				
		a. Check sufficien	nt modes and functions	s of the EGPWS to ver	rify proper operation.	
		b. Verify EGPWS	Annunciations on the	PFDs and MFD.		
АВ	10.	Standby Magnetic	Compass.			
		a. Windshield He	at, Air Conditioner, an	d Landing Lights — (Off.	
		b. All Normally U	Jsed Electronic Equip	ment — On.		
		c. Vent Blower —	- Low.			
			lby compass against se on 4 headings 90° apar		°, 173°, 263°) or against a	flux
		e. The standby conheading.	impass, corrected for d	leviation, shall be with	hin 8° of the known magr	netic
		For	030°	060°	090°	
		Steer				
		For	120°	150°	180°	
		Steer				
		For	210°	240°	270°	
		Steer				
		For	300°	330°	360°	
		Steer				
AB	11.	FMS.				
			on system shall be set uplane interfaces will be		e manufacturer's manual. licable.	The
		a. CDI scaling ch	anges from enroute to	terminal and from ter	minal to approach.	
		b. Go-around butt	ton.			
		c. Performance parallel flight times.	arameters such as fuel	flow, airspeeds, air to	emperatures, winds aloft,	and

ABC

1. Perform Landing Checklist, refer to paragraph 7.2.16.

AΒ

2. Reversing.

9.13 LANDING AND AFTER

- a. Make landing utilizing reversing system.
- b. Check for smoothness of operation and equal thrust from engines.

PROFILE

c. Maximum reverse power shall be 84 - 86% N₁. Record results below.

Left: ______% Right: ______%

- d. Difference between engines shall not exceed 2% N₁.
- e. Left and right propeller speeds shall increase together.
- f. Verify maximum N₂ during reverse does not exceed 1,650 RPM.

AΒ 3. Brake Operation.

- a. During landing run with nose wheel on the ground, apply moderate braking. Verify that:
 - (1) There is no tendency for brakes to bleed down.
 - (2) Braking is symmetrical.
 - (3) Brakes do not drag after release.
 - (4) There is no excessive nose wheel vibration or shimmy.
- 4. Perform After Landing Checklist, refer to paragraph 7.2.17.
- 5. Perform Shutdown and Securing Checklist, refer to paragraph 7.2.18.

ABC

ABC

Figure 9-4. Engine Acceptance At Maximum Continuous Power (16,000 feet, 1,700 RPM)

DATE						IOAT °C	TORQUE %	ITT °C	F/F PPH
Flight No.						16	67	*	382
Pressure Alt.	16,	000	16,	000		14	69	*	388
IOAT						12	71	*	395
Speed (Table)						10	72	*	402
Speed (Indicated)						8	74	820	408
Engine	Left	Right	Left	Right		6	75	819	415
ITT (Table)						4	76	817	421
ITT (Indicated)						2	78	815	426
Torque (Table)						0	79	813	432
Torque (Indicated)						-2	80	811	438
N ₁ (Indicated)						-4	81	809	443
F/F (Table)						-6	82	807	449
F/F (Indicated)						-8	83	805	455
Oil Temperature						-10	85	803	461
Oil Pressure						-12	86	801	467
Pwr Lvr Position						-14	87	799	472
						-16	88	797	478
						-18	89	795	484
						-20	90	793	489
						-22	91	791	495
						-24	92	789	501
						-26	93	787	506
						-28	94	785	512
						-30	95	783	518
						-32	96	781	524
						-34	96	779	529
						-36	97	777	535
						-38	98	775	540
						-40	99	773	546
					_		*1	No testing at	oove 820 °C
						Aircra	ft S/N:		
Left Engine S/N:									

Right Engine S/N: _

Figure 9-5. Engine Acceptance At Maximum Cruise Power (Perform only if ITT limit of Paragraph 9.11, step 21. Speed Performance At Maximum Cruise Power was exceeded) (26,000 feet, 1,500 RPM)

DATE						IOAT °C	TORQUE %	ITT °C	F/F PPH
Flight No.					Ī	16	45	*	228
Pressure Alt.	26,	,000	26,	000	Ī	14	47	*	234
Weight						12	49	*	241
IOAT						10	50	*	247
Speed (Table)	1	60	1	60		8	52	*	253
Speed (Indicated)						6	53	*	259
Engine	Left	Right	Left	Right		4	55	*	265
ITT (Table)						2	56	*	270
ITT (Indicated)						0	57	*	276
Torque (Table)						-2	59	*	281
Torque (Indicated)						-4	60	*	286
N ₁ (Indicated)						-6	61	*	292
F/F (Table)						-8	62	*	297
F/F (Indicated)						-10	63	820	301
Oil Temperature						-12	64	819	306
Oil Pressure						-14	65	817	311
Pwr Lvr Position						-16	66	815	315
						-18	67	813	320
						-20	68	811	324
						-22	69	809	329
						-24	70	807	333
						-26	71	805	337
						-28	72	803	342
						-30	73	801	346
						-32	74	799	351
						-34	75	797	356
						-36	76	795	361
						-38	77	793	366
						-40	77	791	371
*No testing above 820 °C Aircraft S/N:									
	Left Engine S/N:								
Right Engine S/N:									

Figure 9-6. Maximum ITT/N₁ Availability (26,000 feet)

	MAXIMUM ITT/N₁ AVAILABILITY (26,000 FEET):				
Date					
Flight No.					
Pressure Alt	26,0	000	26	,000	
IOAT					
Speed (Indicated)					
Engine	Left	Right	Left	Right	
ITT (Indicated)					
ITT (Maximum)		820	°C	•	
Torque (Indicated)					
N ₁ (Indicated)					
N ₁ (Maximum)		1049	%	•	
F/F (Indicated)					
Pwr Lvr Position					
	•	•		•	
		Aircraft S/	N:		
		Left Engine	e S/N:		
		Right Engir	ne S/N:		

Figure 9-7. Speed Performance At Maximum Cruise Power (First Flight) (For Heavyweight Airplanes With ER Fuel Tanks Installed) (16,000 feet, 1,500 RPM, 12,600 - 13,000 pounds)

	1			
Date				
Flight No.				
Pressure Alt.	16	,000	16	,000
Weight				
IOAT				
Speed (Table)				
Pilot's Speed				
(Indicated)(≥Table)				
Engine	Left	Right	Left	Right
ITT (Table)				
ITT (Indicated)				
ITT (Vanes)				
Torque (Table)				
Torque (Indicated)				
Torques (Vanes)				
N ₁ (Indicated)				
N ₁ (Vanes)				
F/F (Table)				
F/F (Indicated)				
(-25 to +10 PPH)				
F/F (Vanes)				
Oil Temperature				
Oil Pressure				
Pwr Lvr Position				

IOAT °C	TORQUE	ITT °C	F/F PPH	Speed ¹ KTS
8	83	*	394	212
6	85	*	401	214
4	87	820	409	216
2	89	818	416	218
0	91	816	422	220
-2	93	814	429	222
-4	94	812	436	224
-6	96	810	443	226
-8	98	808	449	228
-10	99	806	456	230
-12	100	804	458	230
-14	100	802	458	231
-16	100	800	457	231
-18	100	798	457	232
-20	100	796	457	232
-22	100	794	457	232
-24	100	792	457	233
-26	100	790	457	233
-28	100	788	457	234
-30	100	786	457	234
-32	100	784	456	235
-34	100	782	456	235
-36	100	780	456	236
-38	100	778	455	236
-40	100	776	455	237
-42	100	774	454	237
-44	100	772	454	238
-46	100	770	453	238
-48	100	768	452	239

*NI^	testina	ahove	220	°C
INO	testina	above	02U	\cdot

Aircraft S/N:	
Left Engine S/N:	
Right Engine S/N:	

¹ Increase speed one knot for every 1,000 pounds the test weight is reduced below 12,800 pounds.

Figure 9-8. Speed Performance At Maximum Cruise Power (For Heavyweight Airplanes With ER Fuel Tanks Installed) (26,000 feet, 1,500 RPM, 12,600 - 13,000 pounds)

Date				
Flight No.				
Pressure Alt.	26	,000	26	,000
Weight				
IOAT				
Speed (Table)				
Pilot's Speed				
(Indicated)(≥Table)				
Engine	Left	Right	Left	Right
ITT (Table)				
ITT (Indicated)				
Torque (Table)				
Torque (Indicated)				
N ₁ (Indicated)				
F/F (Table)				
F/F (Indicated)				
(-25 to +10 PPH)				
F/F (Vanes)				
Oil Temperature				
Oil Pressure				
Pwr Lvr Position				

IOAT °C	TORQUE	ITT °C	F/F PPH	Speed ¹ KTS
-7	59	*	274	172
-9	61	*	280	174
-11	62	*	286	176
-13	64	*	292	178
-15	65	820	298	181
-17	67	818	304	183
-19	68	816	309	185
-21	69	814	315	187
-23	71	812	320	188
-25	72	810	325	190
-27	73	808	331	192
-29	75	806	336	194
-31	76	804	341	196
-33	77	802	347	197
-35	78	800	352	199
-37	79	798	357	201
-39	81	796	363	202
-41	82	794	369	204
-43	83	792	375	206
-45	85	790	382	208
-47	86	788	388	210
-49	87	786	394	211

*No testing above 820 °C

Aircraft S/N:	
Left Engine S/N:	
Right Engine S/N:	

¹ Increase speed one knot for every 500 pounds the test weight is reduced below 12,800 pounds.

Figure 9-9. Speed Performance At Maximum Cruise Power (First Flight) (For Heavyweight Airplanes Without ER Fuel Tanks Installed) (16,000 feet, 1,500 RPM, 12,600 - 13,000 pounds)

	1		ī	
Date				
Flight No.				
Pressure Alt.	16	,000	16	,000
Weight				
IOAT				
Speed (Table)				
Pilot's Speed				
(Indicated)(≥Table)				
Engine	Left	Right	Left	Right
ITT (Table)				
ITT (Indicated)				
ITT (Vanes)				
Torque (Table)				
Torque (Indicated)				
Torques (Vanes)				
N ₁ (Indicated)				
N ₁ (Vanes)				
F/F (Table)				
F/F (Indicated)				
(-25 to +10 PPH)				
F/F (Vanes)				
Oil Temperature				
Oil Pressure				
Pwr Lvr Position				

IOAT °C	TORQUE	ITT °C	F/F PPH	Speed ¹ KTS
8	91	817	424	224
6	93	815	431	226
4	95	813	438	228
2	97	811	445	230
0	99	809	452	231
-2	100	807	458	233
-4	100	805	457	234
-6	100	803	457	234
-8	100	801	457	234
-10	100	799	457	235
-12	100	797	457	235
-14	100	795	457	236
-16	100	793	457	236
-18	100	791	457	237
-20	100	789	456	237
-22	100	787	456	237
-24	100	785	456	238
-26	100	783	456	238
-28	100	781	455	239
-30	100	779	455	239
-32	100	777	454	240
-34	100	775	454	240
-36	100	773	453	241
-38	100	771	452	241
-40	100	769	451	242
-42	100	767	450	242
-44	100	765	450	242
-46	100	763	449	242
-48	100	761	449	243

*No	testina	ahove	820	°C.

Aircraft S/N:	
Left Engine S/N:	
Right Engine S/N:	
J	

¹ Increase speed one knot for every 1,000 pounds the test weight is reduced below 12,800 pounds.

Figure 9-10. Speed Performance At Maximum Cruise Power (For Heavyweight Airplanes Without ER Fuel Tanks Installed) (26,000 feet, 1,500 RPM, 12,600 - 13,000 pounds)

Date						IOAT
Flight No.						-7
Pressure Alt.	26	,000	26	,000	,	-6
Weight					,	-1
IOAT					'	-1
Speed (Table)						-1
Pilot's Speed						-1
(Indicated)(≥Table)					,	-1
Engine	Left	Right	Left	Right		-2
ITT (Table)						-2
ITT (Indicated)					'	-2
Torque (Table)						-2
Torque (Indicated)						-2
N ₁ (Indicated)						-3
F/F (Table)						-3
F/F (Indicated)						-3
(-25 to +10 PPH)						-3
F/F (Vanes)						-3
Oil Temperature						-4
Oil Pressure						-4
Pwr Lvr Position						-4
					-	-4
					•	-4

	IOAT °C	Torque %	ITT °C	F/F PPH	Speed ¹ KTS			
	-7	65	*	298	184			
	-9	67	*	304	186			
	-11	68	819	310	188			
	-13	70	817	316	190			
	-15	71	815	321	192			
	-17	73	813	327	194			
	-19	74	811	333	196			
	-21	75	809	338	197			
	-23	76	807	344	199			
	-25	78	805	349	201			
	-27	79	803	355	203			
	-29	81	801	362	205			
	-31	82	799	368	207			
	-33	83	797	375	209			
	-35	85	795	381	211			
	-37	86	793	387	212			
	-39	88	791	394	214			
	-41	89	789	400	216			
	-43	90	787	407	218			
	-45	92	785	413	220			
	-47	93	783	419	221			
	-49	93	781	422	222			
•	*No testing above 820 °C							

*No testing above 820 °C

Aircraft S/N:

Left Engine S/N:

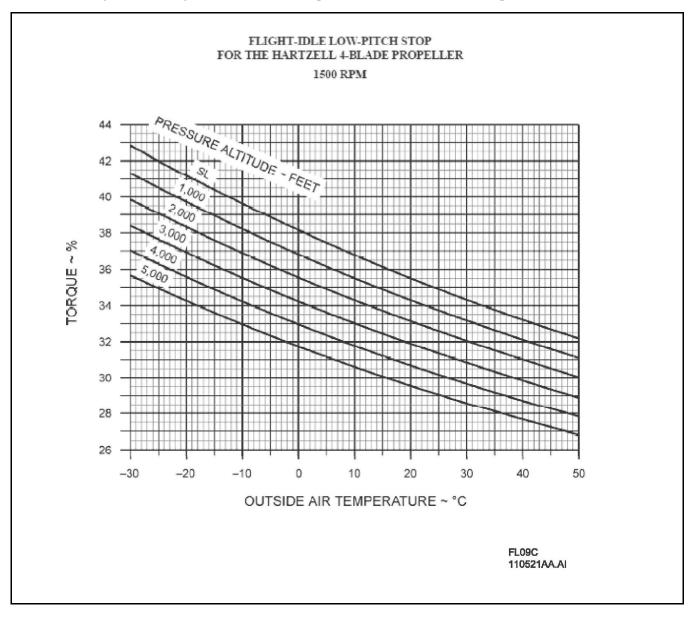
Right Engine S/N: _____

¹ Increase speed one knot for every 500 pounds the test weight is reduced below 12,800 pounds.

Figure 9-11. Engine Data Summary

FINAL RESULTS	TABL OR	E 9-4 9-6	TABL	E 9-1	TABL OR	E 9-5 9-7	TABL	E 9-2	TABL	.E 9-3
Date										
Flight No.										
Pressure Altitude	16,	000	16,0	000	26,	000	26,000		26,000	
Weight			N/	/A					N	/A
IOAT										
Speed (Table)			16	60			16	30		
Pilot's Speed (Indicated)										
Engine	L	R	L	R	L	R	L	R	L	R
Serial No.										
ITT (Table)									820	820
ITT (Indicated)										
Torque (Table)									N/A	N/A
Torque (Indicated)										
N ₁										
F/F (Table)										
F/F (Indicated)										
Oil Temperature									N/A	N/A
Oil									N/A	N/A
Pwr Lvr Position										

Figure 9-12. Flight-Idle Low-Pitch Stop For The Hartzell 4-Blade Propeller 1,500 RPM



PART IV

Flight Characteristics

Chapter 10 — Flight Characteristics

CHAPTER 10

Flight Characteristics

10.1 FLIGHT WITH ONE ENGINE INOPERATIVE

Safe flight with one engine out requires understanding of the basic aerodynamics involved, as well as proficiency in engine-out procedures.

Loss of power from one engine affects both climb performance and controllability of two-engine aircraft. Climb performance depends on an excess of power over that required for level flight. Loss of power from one engine obviously represents a 50% loss of power but, in virtually all twin-engine aircraft, climb performance is reduced by at least 80%. Single-engine climb performance depends on four factors:

- 1. Airspeed Too little, or too much, will decrease climb performance.
- 2. Drag Gear, flaps, and windmilling prop.
- 3. Power Amount available in excess of that needed for level flight.
- 4. Weight Passengers, baggage, and fuel load greatly affect climb performance.

Loss of power on one engine creates yaw due to asymmetric thrust. Yaw forces must be balanced with the rudder. Loss of power on one engine also reduces airflow over the wing. In addition, yaw affects the lift distribution over the wing causing a roll toward the "dead" engine. These roll forces may be balanced by banking slightly (up to 5°) into the operating engine.

10.2 ONE-ENGINE-INOPERATIVE BEST RATE-OF-CLIMB SPEED ($V_{ m YSE}$)

 V_{YSE} is designated by the blue radial on the airspeed indicator. V_{YSE} delivers the greatest gain in altitude in the shortest possible time, and is based on the following criteria:

- 1. Critical engine inoperative, and its propeller in the minimum drag position.
- 2. Operating engine set at not more than the maximum continuous power.
- 3. Landing gear retracted.
- 4. Wing flaps in the most favorable (i.e., best lift/drag ratio) position.
- 5. Aircraft flown at recommended bank angle.

Drag caused by a windmilling propeller, extended landing gear, or flaps in the landing position will severely degrade or destroy single-engine climb performance. Since climb performance varies widely with weight, temperature, altitude, and aircraft configuration, the climb gradient (altitude gain or loss per mile) may be marginal – or even negative – under some conditions.

10.3 SINGLE ENGINE SERVICE CEILING

The single engine service ceiling is the maximum altitude at which the aircraft climbs at a rate of 50 feet per minute in smooth air. Use the single-engine service ceiling graph during flight planning to determine whether the aircraft, as loaded, can maintain theminimum en route altitude (MEA) if IFR, or terrain clearance if VFR, following an engine failure.

10.3.1 Single Engine Procedures

Know and follow to the letter the single-engine emergency procedures specified in Chapter 12, Emergency Procedures. All the procedures have the basic fundamental steps.

- 1. Maintain aircraft control and airspeed at all times.
- 2. Normally apply 100% torque to the operating engine. If the engine failure occurs at speeds below V_{MCA}, however, or during cruise or steep turn, the crew may elect to use enough power to maintain a safe speed and altitude. If the failure occurs on final approach, use power only as necessary to complete the landing.
- 3. Reduce drag to an absolute minimum.
- 4. Secure failed engine and related sub-systems.

The first three steps are completed from memory without consulting the NATOPS Flight Manual. Consult the checklist for step 4. and beyond.

The aircraft must be banked about 5° into the operating engine with the slipskid ball slightly out of center toward the operating engine to achieve rated performance.

Be sure to identify the inoperative engine positively before securing it. Verify with cautious throttle movement.

10.4 WHEN YOU FLY V_X , V_Y , V_{XSE} , AND V_{YSE}

During normal two-engine operations always fly the published take-off speeds on initial climb out. Then, accelerate to your cruise climb airspeed after you have obtained a safe altitude. Use of cruise climb airspeed will give you increased inflight visibility and better fuel economy. However, at first indication of an engine failure during climb out, or while on approach, establish $V_{\rm YSE}$ or $V_{\rm XSE}$, whichever is appropriate.

10.5 STALLS, SLOW FLIGHT, AND TRAINING

The stall warning system must be kept operational at all times and must not be deactivated by interruption of circuits or circuit breakers. Compliance with this requirement is especially important in all high performance multi-engine aircraft during engine-out practice or stall demonstrations, because the stall speed is critical in operation of high-performance aircraft.

The single-engine stall speed of a twin-engine aircraft is generally slightly below the power off (engine idle) stall speed for a given weight condition. Single-engine stalls in multi-engine aircraft are not recommended. Single-engine stalls should not be conducted in high performance aircraft by other than qualified engineering test pilots.

 V_{MCA} demonstrations should not be attempted when the altitude and temperature are such that engine-out minimum control speed is known, or discovered to be, close to the stalling speed. Loss of directional or lateral control, just as a stall occurs, is potentially hazardous.

V_{SSE}, the airspeed belowwhich an engine should not be intentionally rendered inoperative for practice purposes, was established because of the apparent practice of some pilots, instructors, and examiners, of intentionally rendering an engine inoperative at a timewhen the aircraft is being operated at a speed close to, or below, the flight idle stall speed. Unless the pilot takes immediate and proper corrective action under such circumstances, it is possible to enter an inadvertent spin.

It is recognized that flight below V_{SSE} with one engine inoperative, or simulated inoperative, may be required for conditions such as practice demonstration of V_{MCA} for multi-engine pilot certification. This procedure calls for simulating one engine inoperative by reducing the power lever on one engine to zero thrust while operating at an airspeed above V_{SSE} . Power on the other engine is set at maximum, then airspeed is reduced at approximately one knot per second until either V_{MCA} or stall warning is obtained. During this transition, rudder should be used to maintain directional control, and ailerons should be used to maintain 5° bank toward the operative engine. At the first sign of either V_{MCA} or stall warning (which may be evidenced by inability to maintain longitudinal, lateral, or directional control, aerodynamic stall buffet, or stall warning horn sound), recovery must be initiated immediately by

reducing power to zero thrust on the operative engine and lowering the nose to regain $V_{\rm SSE}$. Resume normal flight. This entire procedure should be used at a safe altitude of at least 5,000 feet above ground in clear air only.

If stall warning is detected prior to the first sign V_{MCA} , an engine-out minimum control speed demonstration cannot be accomplished under the existing gross weight conditions and should not be attempted.

10.6 SIMULATING ONE-ENGINE-INOPERATIVE (ZERO THRUST)

When establishing zero thrust operation, use the power setting listed below. By using this power setting to establish zero thrust, one avoids the inherent delays of restarting a shut-down engine and preserves almost instant power to counter any attendant hazard.

- 1. Prop 1,700 RPM.
- 2. Power —5% TORQUE.

WARNING

- Intentional in-flight engine cuts should be simulated by retarding the power lever to zero thrust at or above the V_{SSE} speed of 135 knots.
- For training, this setting will approximate Zero Thrust at low altitudes using recommended One-Engine-Inoperative Climb speeds. The propeller autofeather system is disabled with a power lever retarded.

Note

This setting will approximate Zero Thrust at low altitudes using recommended One-Engine-Inoperative Climb speeds.

10.7 PRACTICE DEMONSTRATION OF V_{MCA}

 V_{MCA} demonstration may be required for multi-engine pilot certification. The following procedure shall be used at a safe altitude of at least 5,000 feet above the ground in clear air only:

WARNING

- Intentional in-flight engine cuts should be simulated by retarding the power lever to zero thrust at or above the $V_{\rm SSE}$ speed of 135 knots.
- For training, this setting will approximate Zero Thrust at low altitudes using recommended One-Engine-Inoperative Climb speeds. The propeller autofeather system is disabled with a power lever retarded.
- 1. Landing gear UP.
- 2. Flaps UP.
- 3. Airspeed ABOVE 135 KNOTS (V_{SSE}).
- 4. Prop levers HIGH RPM.
- 5. Power lever (simulated inoperative engine) ZERO THRUST (5% Torque).
- 6. Power lever (other engine) MAXIMUM ALLOWABLE.

Note

Use the rudder to maintain directional control (heading) and aileron to maintain a 5 degree bank towards the operative engine (lateral attitude). At the first sign of either $V_{\rm MCA}$ or stall warning (which may be evidenced by the inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn sound) immediately initiate recovery by reducing power to idle on the operative engine and immediately lower the nose to regain $V_{\rm SSE}$.

10.8 SPINS

A major causes of fatal accidents in general aviation aircraft is a spin. Stall demonstrations and practices are a means for a pilot to acquire the skills to recognize when a stall is about to occur and to recover as soon as the first signs are evident. If a stall does not occur, a spin cannot occur. The King Air 350 has not been tested for spin recovery characteristics. Intentional spins are prohibited. It is important to remember, however, that a stall can occur in any flight attitude, at any airspeed, if the controls are misused.

The pilot of an aircraft placarded against spins should assume that the aircraft may become uncontrollable in a spin, since its performance characteristics beyond certain limits specified in the FAA regulations have not been tested and are unknown. This is why aircraft are placarded against intentional spins, and this is why stall avoidance is your protection against an inadvertent spin.

Pilots are taught that intentional spins are entered by deliberately inducing a yawing moment with the controls as the aircraft is stalled. Inadvertent spins result from the same combination - stall plus yaw. That is why it is important to use coordinated controls and to recover at the first indication of a stall, when practicing stalls.

In any twin engine aircraft, fundamental aerodynamics dictate that if the aircraft is allowed to become fully stalled while one engine is producing lift-producing thrust, the yawing moment which can induce spin will be present. Consequently, it is important to immediately reduce power on the operating engine, lower the nose to reduce the angle of attack, and increase the airspeed to recover from the stall. In any twin engine aircraft, if application of stall recovery controls is delayed, a rapid rolling and yawing motion may develop, even against full aileron and rudder, resulting in the aircraft becoming inverted during the onset of the spinning motion. Once the aircraft has been permitted to progress beyond the stall and allowed to reach the rapid rolling and yawing condition, the pilot must then immediately initiate the generally accepted spin recovery procedure for multi-engine aircraft, which is as follows:

Immediately move the control column full forward, apply full rudder opposite to the direction of the spin and reduce power on both engines to idle. These three actions should be done as simultaneously as possible; then continue to hold this control position until rotation stops and then neutralize all controls and execute a smooth pull out. Ailerons should be neutral during recovery. The longer the pilot delays before taking corrective action, the more difficult recovery becomes. THE LONGER THE PILOT DELAYS BEFORE TAKING CORRECTIVE ACTION, THE MORE DIFFICULT RECOVERY WILL BECOME.

Always remember that extra alertness and good pilot techniques are required for slow flight maneuvers, including the practice or demonstration of stall or V_{MCA} . In addition to the foregoing mandatory procedures, always:

- 1. Make sure that the CG is as far forward as possible. Forward CG aids stall recovery, spin avoidance, and spin recovery. An aft CG can create a tendency for a spin to flatten out. This delays recovery.
- 2. Conduct any maneuvers which could possibly result in a spin at attitudes in excess of five thousand (5,000) feet above ground level in clear air only.
- 3. Remember that an aircraft, at or near traffic pattern and approach altitudes, cannot recover from a spin, or even a stall before impact with the ground. When descending to traffic altitude, and during pattern entry, and all other flight operations, maintain speed no lower the V_{SSE}. On final approach maintain at least the airspeed shown in the flight manual. Recognize that under some conditions of weight, density altitude, and aircraft configuration, a twin-engine aircraft cannot climb or accelerate on one-engine, hence a single-engine go-around is impossible and the aircraft is committed to landing. Plan your approach accordingly.

- 4. Remember that, if a stall or spin occurs under instrument conditions, the pilot, without reference to the horizon, is certain to become disoriented. He may be unable to recognize a stall, spin entry, or the spin condition and he may be unable to determine even the direction of the rotation.
- 5. Finally never forget that stall avoidance is your best protection against an inadvertent spin. MAINTAIN YOUR AIRSPEED.

10.9 VORTICES-WAKE TURBULANCE

Every aircraft generates wakes of turbulence in flight. Part of this is from the propeller or the jet engine, part from the wing tip vortices. The larger and heavier the aircraft, the more pronounced and turbulent the wakes will be. Wing tip vortices from large heavy aircraft are very severe at close range, degenerating with time, wind, and distance. These are rolling in nature, from each wing tip. In tests, vortex velocities of 133 knots have been recorded. Encountering the rolling effect of wing tip vortices within two minutes after passage of large aircraft is extremely hazardous to small aircraft. This roll effect can exceed the maximum counter roll obtainable in a small aircraft. The turbulence areas may remain for three minutes or more, depending upon wind conditions, and may extend several miles beyond the aircraft. Plan to fly slightly above and to the windward side of other aircraft. Because of the wide variety of conditions that can be encountered, there is not a set rule to follow to avoid wake turbulence in all situations. However, the Aeronautical Information Manual, and to a greater extent Advisory Circular 90-23, Aircraft Wake Turbulence, provides a thorough discussion of factors you should be aware of when wake turbulence may be encountered.

10.10 FLUTTER

Flutter is a phenomenon that can occur when an aerodynamic surface begins vibrating. The energy to sustain the vibration is derived from airflow over the surface. The amplitude of the vibration can decrease if airspeed is reduced, remain constant if airspeed is held constant with no failures, or increase to the point of self-destruction, especially if airspeed is high and/or is allowed to increase.

Flutter can lead to an in-flight break up of the aircraft. Aircraft are designed so flutter does not occur in the normal operating envelope as long as the aircraft is properly maintained.

Decreasing the damping and stiffness of the structure or increasing the trailing edge weight of control surfaces tends to cause flutter. If a combination of those factors is sufficient, flutter can occur within the normal operating envelope.

A thorough preflight inspection can eliminate things that might cause flutter. Improper tension on control cables or any other loose condition in the flight control system can cause or contribute to flutter. Pay particular attention to control surface attachment hardware including tab pushrod attachment. Rectify any looseness of fixed surfaces or movement of control surfaces other than in the normal direction of travel. Control surface drain holes must be open to prevent freezing of accumulated moisture. This also could create an increased trailing edge heavy control surface and flutter.

If excessive vibration, particularly in the control column and rudder pedals, is encountered in flight, this could be the onset of flutter and the procedure to follow is:

- 1. Immediately reduce airspeed; lower landing gear if necessary.
- 2. Restrain controls of the aircraft until vibration ceases.
- 3. Fly at reduced airspeed; land at the nearest suitable airport.
- 4. Have the aircraft thoroughly inspected.

PART V

Emergency Procedures

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CHAPTER 11

Emergency Procedures Introduction

11.1 SCOPE

The procedures contained in this section are considered the best for coping with the various emergencies that may be encountered during operation of the aircraft. Each chapter in this section is divided into two parts, Emergency procedures and Abnormal procedures, and even though the procedures are considered the best possible, sound judgement must be used when multiple emergencies, adverse weather, terrain clearance, etc. are encountered.

11.1.1 Nearest Suitable Airport

The term "Nearest Suitable Airport" is most closely analogous in meaning to the term "Land as Soon as Possible". The intent is to land the aircraft at the nearest airport, in terms of time, provided weather conditions, terrain, and facilities available indicate that a safe landing can be accomplished.

11.1.2 Dual Concurrence Items

Prior to securing, moving, or actuating either Power Lever, Condition Lever, Propeller (Prop) Lever, Firewall Fuel Valve, Generator or Fire Extinguisher in the accomplishment of any Emergency or Abnormal Procedure requires concurrence by both pilots.

11.1.3 Simulated Emergency Training

Simulated emergency training is necessary to develop fully qualified flight crews. The simulated emergencies must be reasonable, applicable, and must not create conditions hazardous to flight safety not normally encountered in an actual emergency; therefore, emergencies shall be practiced in such amanner as to allow sufficient latitude to ensure safe recovery. The rules set forth below shall be adhered to when practicing emergencies.

- 1. During familiarization or transition flights involving scheduled in-flight emergency training that might affect control of the aircraft, no person shall embark in the aircraft other than pilot(s) under instruction, qualified instructor pilot, transport aircrewmen, and transport crewmen under instruction. Stalls and simulated singe-engine landings are included.
- 2. Simulated systems failures shall not be unreasonably compounded. System failures will not be simulated in conjunction with simulated engine failure training, unless such system failure is normally associated with engine failure.
- 3. An instructor pilot shall introduce all emergency training maneuvers to a pilot under instruction and ensure the pilot's knowledge of these maneuvers.
- 4. An instructor pilot shall occupy one of the pilot seats for all stalls, dynamic engine cuts, practice emergency engine shutdowns, and simulated engine failures.
- 5. Simulated engine failure shall not be initiated below either V_{SSE} or 200 feet AGL.
- 6. Simulating a failed engine by moving the condition lever to FUEL CUTOFF or feathering a propeller for emergency training shall not be practiced below 4,000 feet AGL.
- 7. An engine failure for training purposes shall be initiated only by moving a condition lever to FUEL CUTOFF or by retarding a power lever to IDLE.
- 8. Under no circumstances shall an engine be secured or a propeller feathered during a simulated single-engine landing practice.
- 9. For simulated one-engine-inoperative procedures, refer to paragraph 10.6.

- 10. During simulated single-engine approaches, as described above, single-engine waveoffs may be practiced only if executed prior to descending below 200 feet AGL. Any waveoff from a lower altitude during such practice approaches shall be made utilizing both engines. Any time during a simulated single-engine approach that the pilot feels the safety of the aircraft is being jeopardized or is becoming marginal, the pilot shall execute a normal waveoff using both engines and proceed in the safest manner available at the time.
- 11. Simulated single-engine training shall not be practiced:
 - a. Under other than visual meteorological conditions.
 - b. When any actual flight emergency exists.
 - c. During touch-and-go landings, except when both engines are available and utilized normally for succeeding takeoff.
- 12. During maneuvers requiring large rudder inputs (e.g., V_{SSE} dynamic engine cut), ensure yaw damper is not engaged.

11.2 ANNUNCIATOR SYSTEM

When a lens on the Warning Annunciator Panel illuminates, refer to Figure 11-1.

When a lens on the Caution/advisory/status Annunciator Panel illuminates, refer to Figure 11-2.

Figure 11-1. Warning Annunciator Panel (Sheet 1 of 2)

		DOOR UNLOCK		
L FUEL PRES LO		CABIN ALT HI	CABIN DIFF HI	R FUEL PRES LO
L OIL PRES LO		MISSILE THREAT		R OIL PRES LO
	L BLEED FAIL		R BLEED FAIL	

Figure 11-1. Warning Annunciator Panel (Sheet 2)

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION	PAGES AFFECTED
DOOR UNLOCKED	Red	Airstair or cargo door open or not secure.	12-6
L FUEL PRES LO	Red	Fuel pressure failure on left side.	12-3
CABIN ALT HI	Red	Cabin pressure altitude exceeds 12,000 feet.	12-16
CABIN DIFF HI	Red	Cabin differential pressure exceeds 6.9 psi.	12-16
R FUEL PRES LO	Red	Fuel pressure failure on right side.	12-3
L OIL PRES LO	Red	Low oil pressure left engine.	12-3
MISSILE THREAT	Red	ASE detected threat.	N/A
R OIL PRES LO	Red	Low oil pressure right engine.	12-3
L BLEED FAIL	Red	Melted or failed plastic left bleed air failure warning line.	12-17
R BLEED FAIL	Red	Melted or failed plastic right bleed air failure warning line.	12-17

Figure 11-2. Caution/Advisory/Status Annunciator Panel (Sheet 1 of 3)

L DC GEN	L GEN TIE OPEN	HYD FLUID LOW	RVS NOT READY	R GEN TIE OPEN	R DC GEN
L CHIP DETECT	L NO FUEL XFR	BAT TIE OPEN	DUCT OVERTEMP	R NO FUEL XFR	R CHIP DETECT
L ENG ICE FAIL	L FUEL QTY	ELEC HEAT ON	EXT PWR	R FUEL QTY	R ENG ICE FAIL
L BL AIR OFF	AUTOFTHER OFF		OXY NOT ARMED	RUD BOOST OFF	R BL AIR OFF
L PITOT HEAT	CVDR/FDR FAIL		PROP GND SOL	IFF	R PITOT HEAT
L IGNITION ON	L ENG ANTI-ICE	FUEL CROSSFEED		R ENG ANTI-ICE	R IGNITION ON
WING DEICE	L BK DEICE ON	MAN TIES CLOSE		R BK DEICE ON	TAIL DEICE
L PROP PITCH	CABIN ALTITUDE	LDG/TAXI LIGHT	PASS OXYGEN ON	AIR COND N₁ LOW	R PROP PITCH

Figure 11-2. Caution/Advisory/Status Annunciator Panel (Sheet 2)

NOMENCLATURE	IENCLATURE COLOR CAUSE FOR ILLUMINATION		PAGES AFFECTED	
L DC GEN	Amber	Left generator off the line.	13-7	
L GEN TIE OPEN	Amber	Left generator bus isolated from center bus.	13-8	
HYD FLUID LOW	Amber	Hydraulic fluid in the power pack is low.	13-9	
R GEN TIE OPEN	Amber	Right generator bus isolated from center bus.	13-8	
R DC GEN	Amber	Right generator off the line.	13-7	
L CHIP DETECT	Amber	Metal contamination in the left engine oil is detected.	13-6	
L NO FUEL XFR	Amber	No left auxiliary fuel transfer.	13-7	
BAT TIE OPEN	Amber	Battery isolated from generator buses.	13-8	
DUCT OVERTEMP	Amber	Duct air too hot.	13-10	
R NO FUEL XFR	Amber	No right auxiliary fuel transfer.	13-7	
R CHIP DETECT	Amber	Metal contamination in right engine oil is detected.	13-6	
L ENG ICE FAIL	Amber	Left engine selected anti-ice system is inoperative.	13-11	
L FUEL QTY	Amber	Left fuel quantity — less than 30 minutes remaining at maximum continuous power.	13-7	
ELEC HEAT ON	Amber	Electric heat is on.	13-10	
R FUEL QTY	Amber	Right fuel quantity — less than 30 minutes remaining at maximum continuous power.	13-7	
R ENG ICE FAIL	Amber	Right engine selected anti-ice system inoperative.	13-11	
L PITOT HEAT	Amber	Left Pitot Heat inoperative or switch is in the OFF position.	13-12	
CVDR/FDR FAIL	Amber	Internal fault with either CVDR or FDR.	13-19	
PROP GND SOL	Amber	28v is being delivered to one or both ground idle low pitch stop solenoids.	13-6	
IFF	Amber	IFF is inoperative. 13-19		
R PITOT HEAT	Amber	Right Pitot Heat inoperative or switch is in the OFF position.		

Figure 11-2. Caution/Advisory/Status Annunciator Panel (Sheet 3)

NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION	PAGES AFFECTED
L IGNITION ON	Green	Left ignition and engine start switch is on, or left auto ignition system is armed and left engine torque is below 17%.	N/A
FUEL CROSSFEED	Green	Crossfeed valve is open.	N/A
R IGNITION ON	Green	Right ignition and engine start switch is on, or right auto ignition system is armed and right engine torque is below 17%.	N/A
WING DEICE	Green	Wing surface deice system in operation.	N/A
L BK DEICE ON	Green	Left brake deice system in operation.	N/A
MAN TIES CLOSE	Green	Manually closed generator bus ties.	N/A
R BK DEICE ON	Green	Right brake deice system in operation.	N/A
TAIL DEICE	Green	Horizontal stabilizer surface deice system in operation.	N/A
LEFT PROP PITCH	White	Left propeller is below the flight idle stop.	N/A
CABIN ALTITUDE	White	Cabin Altitude exceeds 10,000 feet.	N/A
LDG/TAXI LIGHT	White	Landing light(s) or taxi light on with landing gear up.	N/A
PASS OXYGEN ON	White	Passenger oxygen system charged.	N/A
AIR COND N₁ LOW	White	Right engine N ₁ too low for air conditioning load.	N/A
RIGHT PROP PITCH	White	Right propeller is below the flight idle stop.	N/A

11.3 EMERGENCY AIRSPEEDS (16,500 LBS (7,484 KG))

1. One-engine-inoperative:

Best-angle-of-climb (V_{XSE}) — 135 Knots.

2. One-engine-inoperative:

Best-rate-of-climb (V_{YSE}) — 135 Knots.

- 3. One-engine-inoperative enroute climb 135 Knots.
- 4. Air minimum control speeds (V_{MCA}) :
 - a. Flaps up 103 Knots.
 - b. Flaps approach 99 Knots.
- 5. Emergency descent 182 Knots.
- 6. Maximum range glide 135 Knots.

CHAPTER 12

Emergency Procedures

Note

- All airspeeds quoted in this section are Indicated Airspeeds (IAS) and assume zero instrument error.
- Closed [BRACKETS] in this section denote annunciator(s).
- Immediate action items are delineated by (*) with the remaining procedures following.
- Items marked with (†) indicate dual concurrence.

12.1 HOT START OR HUNG START

- *1. Condition lever FUEL CUTOFF.
- *2. Ignition and engine start STARTER ONLY.
- *3. ITT below 400 °C IGNITION AND ENGINE START OFF.
- 4. Do not attempt another start until the cause of the hot start or hung start has been corrected.

12.2 ENGINE FAILURE

Note

To obtain best performance with one engine inoperative, the airplane must be banked 3 degrees to 5 degrees into the operating engine while maintaining a constant heading.

12.2.1 Basic Single Engine Procedures

- 1. Maintain airplane control and airspeed at all times.
- 2. Usually, apply 100% torque to the operating engine. However, if the engine failure occurs at a speed below V_{MCA}, or during cruise or in a steep turn, you may elect to use only enough power to maintain a safe speed and altitude. If the failure occurs on final approach, use power only as necessary to complete the landing.
- 3. Reduce drag to an absolute minimum.
- 4. Secure the failed engine and related sub-systems.

The first three steps should be done promptly and from memory. The check list should then be consulted to be sure that the inoperative engine is secured properly and that the appropriate switches are placed in the correct position. The airplane must be banked about 5° into the live engine, with the "slip/skid" ball slightly out of center toward the live engine, to achieve rated performance.

Note

Be sure to identify the dead engine positively before securing it. First, identify the suspected engine. Second, verify with cautious throttle movement, then secure.

12.2.2 Engine Fire or Failure in Flight

Affected engine:

- †*1. Condition lever FUEL CUTOFF.
- †*2. Prop lever FEATHER.
- †*3. Firewall fuel valve CLOSE, [EXTINGUISHER PUSH] & [CLOSED] ILLUMINATED.
- †*4. Fire extinguisher (if fire warning persists) ACTUATE, [DISCHARGED] ILLUMINATED.
- †5. Generator OFF.
- 6. Engine auto ignition OFF.
- 7. Autofeather OFF.
- 8. Brake deice OFF.
- 9. Electrical load MONITOR.

12.2.3 Engine Fire on Ground

Affected engine:

- †*1. Condition lever FUEL CUTOFF.
- †*2. Firewall fuel valve CLOSE, [EXTINGUISHER PUSH] & [CLOSED] ILLUMINATED.
- *3. Starter Switch Starter Only.
- †*4. Fire extinguisher (if fire warning persists) ACTUATE, [DISCHARGED] ILLUMINATED.

12.2.4 Emergency Engine Shutdown on The Ground

- *1. Condition levers FUEL CUTOFF.
- *2. Prop levers FEATHER.
- *3. Firewall fuel valves CLOSE, [EXTINGUISHER PUSH] & [CLOSED] ILLUMINATED.
- *4. Master switch (gang bar) OFF.
- *5. Battery bus EMERG OFF.
- *6. ESIS power OFF.

12.2.5 Engine Failure During Takeoff (At Or Below V₁) — Takeoff Aborted

- *1. Power levers GROUND FINE.
- *2. Brakes MAXIMUM (or as required to achieve stopping distance).

WARNING

Do not use reverse thrust with one engine inoperative. Care must be exercised when using single-engine ground fine on surfaces with reduced traction.

12.2.6 Engine Failure During Takeoff (At Or Above V₁) — Takeoff Continued

- *1. V_R speed ROTATE TO APPROXIMATELY 10° PITCH ATTITUDE.
- *2. Landing gear (when positive climb established) UP.

- *3. Airspeed MAINTAIN V₂ TO 400 FT AGL.
- *4. Propeller (inoperative engine) VERIFY FEATHERED.

WARNING

Do not retard the failed engine power lever until the autofeather system has completely stopped propeller rotation. To do so will deactivate the autofeather circuit and prevent automatic feathering.

- *5. Airspeed (at 400 ft AGL minimum) INCREASE TO 135 KNOTS.
- *6. Flaps UP.
- 7. Climb to 1500 ft AGL, then accomplish the following cleanup procedures on the inoperative engine:
 - †a. Condition lever FUEL CUTOFF.
 - †b. Prop lever FEATHER.
 - †c. Firewall fuel valve CLOSE, [EXTINGUISHER PUSH] AND [CLOSED] ILLUMINATED.
 - †d. Generator OFF.
 - e. Engine auto ignition OFF.
- 8. Autofeather OFF.
- 9. Brake deice OFF.
- 10. Electrical load MONITOR.

12.2.7 Engine Failure in Flight Below Air Minimum Control Speed (V_{MCA})

- *1. Power REDUCE AS REQUIRED TO MAINTAIN CONTROL.
- *2. Nose LOWER TO ACCELERATE ABOVE V_{MCA}.
- 3. Power AS REQUIRED.
- 4. Engine SECURE (Engine Fire or Failure in Flight, paragraph 12.2.2).

12.2.8 Oil Pressure Low [L OIL PRES LO] or [R OIL PRES LO]

1. Oil pressure — CONFIRM BELOW 60 PSI.

If confirmed:

2. Engine — SECURE (Engine Fire or Failure in Flight, paragraph 12.2.2).

Or:

3. Land at the nearest suitable airport using the minimum power required to sustain flight.

12.3 FUEL SYSTEM

12.3.1 Fuel Pressure Low [L FUEL PRES LO] or [R FUEL PRES LO]

- 1. Standby pump (failed side) ON.
- 2. [FUEL PRES LO] EXTINGUISHED.
- 3. Oil temperature indicator (failed side) MONITOR.

12.4 SMOKE AND FUME ELIMINATION

Attempt to identify the source of smoke or fumes. Smoke associated with electrical failures is usually gray or tan in color, and irritating to the nose and eyes. Smoke produced by environmental system failures is generally white in color, and much less irritating. If smoke is prevalent in the cabin, cabin oxygen masks should not be intentionally deployed. If masks are automatically deployed due to an increase in cabin altitude, passengers should be instructed not to use them unless the cabin altitude exceeds 15,000 feet, and then they should be used only until the cabin altitude is reduced to 15,000 feet or lower.

12.4.1 Windshield Electrical Fault

The smell of an electrical overheat, or observing smoke and/or fire at the lower inboard corner of either windshield, adjacent to the center post, may indicate an overheat condition in the electrical power terminal for the normal heat mode of the pilots or copilots windshield heat.

1. WSHLD ANTI-ICE switches — OFF.

If smoke and/or fire does not cease:

2. Conduct Electrical Smoke or Fire, paragraph 12.4.2.

If smoke and/or fire ceases:

3. Continue flight with windshield anti-ice OFF if possible.

If windshield anti-ice is required:

4. If the source of the smell, smoke, or fire can be isolated to the pilots or copilots windshield, the opposite windshield (without the overheat condition) may be operated in the NORMAL or HI windshield heat mode.

12.4.2 Electrical Smoke or Fire

- *1. Helmet(s) Remove (as required).
- *2. Oxygen mask(s) DON.
- *3. Mask selector switch EMERG.
- *4. Mic switch(es) OXY.
- *5. Speaker switch(es) As required.
- 6. Instrument emergency lights (if required) ON.
- 7. Generators OFF.

Note

Equipment which remains operable and is controllable by the pilot is indicated by a white circle around the control. These items may be turned off to further isolate the cause of the fire/smoke.

- 8. ECS mode MAN HEAT.
- 9. Envir bleed air NORMAL.
- 10. Cockpit temp FULL INCREASE.
- 11. Cabin temp FULL DECREASE.
- 12. Man temp AS REQUIRED.
- 13. Cockpit/Cabin Blower AS REQUIRED.
- 14. Cockpit door OPEN.

WARNING

Dissipation of smoke is not sufficient evidence that a fire has been extinguished. If it cannot be visually confirmed that no fire exists, land at the nearest suitable airport.

If smoke persists or if extinguishing of fire is not confirmed:

- 15. Avionics master OFF (use ESIS for airplane control).
- 16. Cabin pressurization (if desired) DUMP.

After allowing cabin to dump:

- 17. Master switch (gang bar) OFF.
- 18. Storm window (if required) OPEN BELOW 13,500 FT.
- 19. Land NEAREST SUITABLE AIRPORT:
 - a. GND COM switch PRESS TO RESTORE COMM 1.
 - b. Flaps PLAN ON A FLAPS-UP LANDING.
 - c. Landing gear LOWER MANUALLY.
- 20. If conditions require the partial restoration of power, one or more of the following procedures may be used. Verify proper voltage on the Voltmeter. Each set of procedures assumes the Master Switch (gang bar) is initially off.
 - a. To restore left generator bus and triple fed bus only:
 - (1) Gen Ties OPEN.
 - (2) Left generator RESET, THEN ON.
 - (3) Avionics master (if required) ON.
 - b. To restore right generator bus and triple fed bus only:
 - (1) Gen Ties OPEN.
 - (2) Right generator RESET, THEN ON.
 - (3) Avionics master (if required) ON.
 - c. To restore all buses except the center bus:
 - (1) Gen Ties OPEN.
 - (2) Left and right generators RESET, THEN ON.
 - (3) Battery ON.
 - (4) Bus sense switch TEST.
 - (5) Avionics master (if required) ON.
 - d. To restore the battery bus, triple fed bus, and center bus only:
 - (1) Battery ON.
 - (2) Avionics master (if required) ON.

12.4.3 Environmental System Smoke or Fumes

- *1. Helmet(s) Remove (as required).
- *2. Oxygen mask(s) DON.
- *3. Mask selector switch EMERG.
- *4. Mic switch(es) OXY.
- *5. Speaker switch(es) As required.
- 6. ECS mode MAN HEAT.
- 7. Cockpit/Cabin blower AS REQUIRED.
- 8. Left bleed air valve PNEU and ENVIR OFF.

If smoke decreases:

9. Continue operation with left bleed air off.

If smoke does not decrease:

- 10. Left bleed air valve OPEN.
- 11. Right bleed air valve PNEU and ENVIR OFF.

If smoke decreases:

12. Continue operation with right bleed air off.

Note

Each bleed air valve must remain closed long enough to allow time for smoke purging to positively identify the smoke source.

If smoke persists:

- 13. Bleed air valves ENVIR OFF.
- 14. Cabin pressurization DUMP.
- 15. Storm window (if required) OPEN BELOW 13,500 FT.
- 16. Land NEAREST SUITABLE AIRPORT.

12.5 AIRSTAIR DOOR/CARGO DOOR UNLOCKED [DOOR UNLOCKED]

WARNING

Do not attempt to check the security of the airstair door or cargo door in flight. Remain as far from the door as possible with seatbelts securely fastened.

If the [DOOR UNLOCKED] illuminates, or if an unlatched airstair door/cargo door is suspected:

- *1. All occupants SEATED WITH SEAT BELTS SECURELY FASTENED.
- 2. Cabin sign FSB.

- 3. Cabin differential pressure REDUCE TO LOWEST VALUE PRACTICAL (zero preferred):
 - a. Descend.

And/or:

- b. Select higher cabin altitude setting.
- 4. Oxygen AS REQUIRED.
- 5. Land NEAREST SUITABLE AIRPORT.

12.6 EMERGENCY DESCENT

- *1. Power levers IDLE.
- *2. Prop levers FULL FORWARD.
- *3. Flaps (202 knots maximum) APPROACH.
- *4. Landing gear (182 knots maximum) DOWN.
- *5. Airspeed 182 KNOTS MAXIMUM.

12.7 EMERGENCY LANDING

- 1. Approach speed (V_{REF}) CONFIRM.
- 2. Cabin sign FSB.
- 3. Autofeather ARM.
- 4. Flaps APPROACH.
- 5. Landing gear DOWN.

Note

If landing gear does not operate, execute Landing Gear Fails to Retract/Unsafe Gear Indications/Landing Gear Fails to Extend/Landing Gear Manual Extension procedure (paragraph 13.9.2).

- 6. Exterior and interior lights AS REQUIRED.
- 7. Radar AS REQUIRED.
- 8. Surface deice AS REQUIRED.
- 9. Pressurization DUMP.
- 10. Flaps DOWN.
- 11. Airspeed V_{REF}.
- 12. Yaw Damp OFF.
- 13. Prop levers FULL FORWARD.
- 14. Power levers IDLE.

After touchdown:

- 15. Power levers LIFT AND SELECT GROUND FINE.
- 16. Brakes AS REQUIRED.

After airplane comes to a stop:

- 17. Condition levers FUEL CUTOFF.
- 18. Firewall fuel valves CLOSE, [EXTINGUISHER PUSH] & [CLOSED] ILLUMINATED.
- 19. Master switch (gang bar) OFF.
- 20. Battery bus EMER OFF.

12.8 GLIDE

- *1. Landing gear UP.
- *2. Flaps UP.

WARNING

Do not feather second engine propeller if a No Starter Assist Air Start is to be conducted. Air Starts with a windmilling propeller will result in lower starting temperatures. Refer to Air Start procedures, paragraph 13.3.

- *3. Prop levers FEATHERED.
- *4. Airspeed 135 KNOTS.
- 5. Glide ratio 2.3 nautical miles for each 1,000 feet of altitude:

 Decrease by 0.2 nautical miles for each 10 knots of headwind.
- 6. ELT switch ON, Yellow [XMT] BLINKING.

12.9 DITCHING

The following ditching procedures are based on the experiences of pilots who have successfully ditched other multi-engine aircraft. These ditches were successful because all crewmembers carried out the correct procedures. Ditches commenced from low altitudes do not always allow time for more than minimum preparation and planning and may not permit relying on a checklist; therefore, it is essential that each crewmember be thoroughly familiar with ditching procedures and assigned responsibilities. Further, the Aircraft Commander must ensure that all passengers have been briefed on the procedures and that they understand how to use installed survival equipment. If at all possible, a ditch should be made while power is still available on both engines; however, if one engine has failed, a ditch should be accomplished in as near symmetrical condition as possible. An engine and/or wing fire is probably the most serious condition from the standpoint of structural integrity and lateral control. A fire concentrated within the wing or nacelle will be sustained by fuel or oil and will destroy effective use of flaps and ailerons in a very short time. With such a fire, except in extremely high wind conditions, the aircraft should be ditched parallel to the primary swell system. Model tests and actual ditches of various aircraft indicate that ditching into the wall of water created by the major swell is roughly analogous to flying into a mountain. Accordingly a careful evaluation of sea condition is essential to successful ditching. While descending, begin analyzing the sea condition as soon as the surface can be seen clearly, 2,000 feet or more if possible. The primary swell can readily be distinguished from high altitude and will be seen first. At low altitude it may be hidden beneath another system plus a surface chop, but from altitude the largest and most dangerous system will be the first one recognized. The wind-driven sea, if any, will be recognized by the appearance of white caps. Where IMC or night operations preclude visual determination of sea conditions, forecast data should be utilized and the ditch must be made on instruments. With no surface reference, the aircraft must be flown into the water on heading and in a fixed attitude that combines safe control speed and rate of descent. Whenever possible, a ditch should be made as close as safety permits to coastlines or in the vicinity of surface vessels to improve the rescue situation. If radios are still available, attempt to contact coastal stations and/or surface vessels for current wind, sea swell, and altimeter setting.

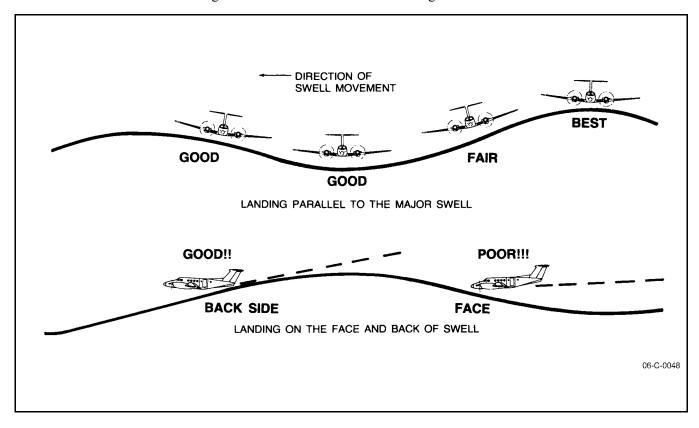
Note

• Ditch parallel to and near the crest of the swell unless there is a strong crosswind of 20 knots or more. In strong winds, ditch heading should be more into the wind and slightly across the swell, planning to touch down on the upslope of the swell near the top. Refer to Figure 12-1. Wave motion is indicative of wind direction, but the swell does not necessarily move with the wind. Water surface conditions are indicative of windspeed, as related below:

SURFACE CONDITIONS	WINDSPEED KNOTS
Few white crests	10 to 15
Many white crests	15 to 25
Streaks of foam from crests	25 to 35
Spray blown from tops of waves	35 to 45

- Use of radio altimeter gives a fair approximation of height above the surface.
- Full flaps are recommended for power-on ditches; however, impaired directional control caused by engine loss or aileron damage is another factor to be considered in determining the ditch configuration. If directional control problems are anticipated and available power is insufficient to maintain desired rate of descent, consideration should be given to utilization of approach flaps.

Figure 12-1. Wind Swell Ditch Heading Evaluation



12.9.1 Ditch/Forced Landing Checklist

- 1. Announce intention and time to ditch (PNF).
- 2. Mayday message Transmit (PNF).
- 3. Transponder EMERGENCY (PNF).
- 4. Cabin pressurization DUMP (PNF).
- 5. Lifevest On and adjusted (do not inflate).
- 6. Cabin emergency hatch Remove and jettison as required (TA).
- 7. Seatbelts/harnesses Secure (passengers brace position).
- 8. Interior lights As desired.
- 9. Landing gear As required.
- 10. Flaps As required.
- 11. Airspeed As required.

12.9.2 Ditch/Forced Landing (Aircrew)

- 1. Passengers Briefed.
 - a. Remove all sharp objects.
 - b. Operation of emergency exits.
 - c. Assignment of after ditch duties.
 - d. Proper brace position.
- 2. Don lifevest As required.
 - a. Survival radio Retrieved and stow in pocket.
- 3. Escape hatch Secure or jettison as directed.
- 4. Bags/cargo Jettison as required.
 - a. Pilots Notified.
- 5. Brace position Assume.
- 6. After all violent motion stops Evacuate aircraft.
- 7. Raft/survival equipment As required.

After a ditch or forced landing, egress should proceed as follows:

- 1. First person out assists others.
- 2. Aircrewman ensures passengers have exited aircraft.
- 3. Aircrewman brings liferaft and survival kit forward and passes them out to a crewmember, then egresses. As there will be no passengers in the aircraft, use the seatbacks for support while dragging the survival kit and liferaft to the emergency exit.

12.9.3 Ditching Technique

12.9.3.1 Ditching (Two Engines)

1. Landing gear — UP.

- 2. Flaps DOWN.
- 3. Airspeed V_{ref} (100 fpm rate of descent).

Note

- Rate of descent is 100 fpm during final stages of the approach (approximately last 300 feet).
- Time permitting, aircrew may silence warning horns by pulling associated circuit breakers.

12.9.3.2 Ditching (Single Engine)

- 1. Landing gear UP.
- 2. Flaps As desired.
- 3. Airspeed V_{ref} (100 fpm rate of descent).

Note

Rate of descent is 100 fpm during final stages of the approach (approximately last 300 feet).

12.9.3.3 Ditching (No Power Available)

- 1. Propeller levers FEATHERED.
- 2. Landing gear UP.
- 3. Flaps As desired.
- 4. Airspeed V_{ref}.

Note

Rate of descent should be such that airspeed is maintained at 135 KIAS (maximum glide airspeed) until approximately 200 feet AGL, at which time transition should be made to desired flap position. Allow airspeed to bleed off with a slight nose-up attitude prior to impact by using radio altimeter or any visual reference to the water surface. Water entry should be approximately $V_{\rm ref}$ with maximum rate of descent 100 to 200 fpm.

12.9.3.4 Water Entry

It is essential that an attempt be made to control the attitude of the aircraft throughout the ditching until all motion stops.

12.10 ELECTRICAL

12.10.1 Dual Generator Failure [L DC GEN] & [R DC GEN]

- *1. Instrument emergency lights (if required) ON.
- *2. Generators RESET, THEN ON.

If either generator will reset:

*3. Operating generator loadmeter — MONITOR.

If neither generator will reset:

*4. ECS mode — OFF.

- *5. Cockpit/Cabin blower AUTO.
- *6. Non-essential equipment OFF.
 - a. Evaluate flight environment.
 - (1) Determine the threat environment. If the aircraft survivability equipment is not required: Mission Power Annunciator Switch (pedestal) OFF.
 - (2) If the threat environment requires aircraft survivability equipment:
 Pull circuit breakers as desired to reduce the load on the battery. Refer to Figure 12-2, Added Systems Circuit Breakers and Associated Locations and Busing.
- 7. Autopilot DISENGAGE.
- 8. Battery ammeter MONITOR.
- 9. Land NEAREST SUITABLE AIRPORT.
- 10. Pressurization SET.
- 11. Altimeter SET.
- 12. Cabin sign VERBAL BRIEFING REQUIRED.
- 13. Autofeather ARM.
- 14. Fuel balance CHECK.
- 15. V_{REF} +25 DETERMINE.
- 16. Environmental bleed air LOW.
- 17. Flaps UP.
- 18. Landing gear EXTEND MANUALLY.
- 19. Taxi light AS REQUIRED.
- 20. Surface deice AS REQUIRED.
- 21. Airspeed V_{REF} +25 KNOTS.
- 22. Yaw damp OFF.
- 23. Prop levers FULL FORWARD.
- 24. Power levers IDLE.

After Touchdown:

- 25. Power levers REVERSE.
- 26. Brakes AS REQUIRED.

Figure 12-2. Added Systems Circuit Breakers and Associated Locations and Busing

NOMENCLATURE	C/B	LOCATION	28VDC BUS
Stormscope	2A	RH C/B Panel	Avionics Rt Gen Bus
ELT	1/2A	RH C/B Panel	Avionics Rt Gen Bus
3rd Crew Audio	2A	RH C/B Panel	Avionics Rt Gen Bus
MISSION BUS	1/2A	RH C/B Panel	RCCB Center Bus Ctrl 2
No. 3 GPS	3A	ASE Rack C/B Panel	Center Bus -2

Figure 12-2. Added Systems Circuit Breakers and Associated Locations and Busing (cont.)

NOMENCLATURE	C/B	LOCATION	28VDC BUS
TACAN	5A	ASE Rack C/B Panel	Center Bus -2
IFF XPNDR	5A	ASE Rack C/B Panel	Center Bus -2
WARNING	7.5A	ASE Rack C/B Panel	Center Bus -2
FLARE CONT	5A	ASE Rack C/B Panel	Center Bus -2
FLARE PWR	10A	ASE Rack C/B Panel	Center Bus -2
FAN PWR	1A	ASE Rack C/B Panel	Center Bus -2

CAUTION

The propeller ground idle stop solenoids will be inoperative rendering the effectiveness of the propeller Ground Fine and Reverse power lever settings ineffective or greatly reduced. Plan on longer landing distances.

Note

Equipment which remains operable is designated with a WHITE CIRCLE around the control switch. Attitude reference is by Pilot PFD or ESIS.

12.10.2 Load Management With A Dual Generator Failure

After a dual generator failure, a charged battery will discharge in the following times (Figure 12-3):

The following equipment will remain operable after a dual generator failure. With only the equipment operating listed as "continuous" in the "OPERATING TIME" column, the battery duration will be approximately 30 minutes (based upon a 50-amp load).

Use of the equipment with prescribed operating times will reduce the battery duration by the approximate times listed in paragraph 12.10.3, Load Management Table. Multiple usage of this equipment is additive.

WARNING

Do not place the GEN TIES switch in the MAN CLOSE position. This action reconnects the left and right generator bus loads to the battery, severely limiting battery duration.

Figure 12-3. Battery Discharge Time

BATTERY DISCHARGE RATE — AMPS	TIME TO DISCHARGE — MIN
60	27
50	32
40	40
30	54
20	81
10	162

12.10.3 Load Management Table

EQUIPMENT	OPERATING TIME (Minutes)	REDUCTION IN MA BATTERY DURATIO (Minutes)
Standby ESIS Display	Continuous	None *
Comm 1 Xmit	3	0.5
Pilot Audio	Continuous	
Cabin Audio	Continuous	
Nav 1	Continuous	
ATC 1	Continuous	
Pilot PDF	Continuous	
MDF	Continuous	
Pilot DCP	Continuous	
Annunicator Panel	As Required	
DCU-1 Sec	Continuous	
DCU-2 Sec	Continuous	
Left IAPS	Continuous	
Right IAPS	Continuous	
FGC-1 Servo	Continuous	
FGC-2 Servo	Continuous	
ADC 1	Continuous	
AHC 1	Continuous	
Instrument Indirect/Emergency Lights	Continuous	
Cabin Lights	5	2
Ice Lights	5	0.5
Beacon Lights	Continuous	
Taxi Lights	1	0.5
Digital OAT	Continuous	
Fuel Quantity Indicators	Continuous	
Single Standby Fuel Pump	5	1
Left Bleed Air Valve	Continuous	
Pressurization Control	Continuous	
Cabin Temperature Control	Continuous	
Engine Ignition	0.5	0.1
Surface Deice	5 cycles	0.1
Left and Right Main Engine Anti-ice	Single Operation	0.1
Manual Prop Deice	3	3
Windshield Wiper	1	0.1
Left Pitot Heat	Continuous	
Landing Gear	Single Operation	0.5
*Powered by battery.		

12.11 ENVIRONMENTAL SYSTEMS

12.11.1 Use of Oxygen

WARNING

- Beards and mustaches should be carefully trimmed so that they will not
 interfere with the proper sealing of an oxygen mask. The fit of the oxygen
 mask around the beard or mustache should be checked on the ground for
 proper sealing. Studies conducted by the military and the FAA conclude that
 oxygen masks do not seal over beards and mustaches. Hats and ear-muff type
 headsets must be removed prior to donning crew oxygen masks. Headsets
 and eyeglasses worn by crew members may interfere with quick-donning
 capabilities.
- Figure 12-4 sets forth the average time of useful consciousness (TUC) (time from onset of hypoxia until loss of effective performance) at various altitudes. Rapid decompressions can reduce these times to 1/3 to 1/2 of their original value.

12.11.1.1 Crew

- *1. Helmet(s) Remove (as required).
- *2. Oxygen mask(s) DON.
- *3. Mask selector switch EMERG.
- *4. Mic switch(es) OXY.
- *5. Speaker switch(es) As required.
- 6. Oxygen duration CONFIRM (refer to Oxygen Duration, paragraph 7.3.1).

To discontinue use:

- 7. Oxygen mask(s) RETURN TO OVERHEAD CONTAINER.
- 8. Mic switch(es) NORMAL.

12.11.1.2 Passengers



The highest recommended cabin altitude for sustained flight is 25,000 feet.

Figure 12-4. Average Time Of Useful Consciousness (TUC)

CABIN PRESSURE ALTITUDE	TUC
35,000 feet	1/2 to 1 minute
30,000 feet	1 to 2 minutes
25,000 feet	3 to 5 minutes
22,000 feet	5 to 10 minutes
12 to 18,000 feet	30 minutes or more

- 1. Passenger manual drop-out PULL ON, [PASS OXYGEN ON] ILLUMINATED.
- 2. Lanyard pin for each mask used PULL OUT.
- 3. Mask DON.
- 4. Oxygen duration CONFIRM (refer to Oxygen Duration, paragraph 7.3.1).

To discontinue use:

- 5. Passenger manual drop-out PUSH OFF.
- 6. Lanyard pin INSERT.
- 7. Mask RETURN TO COMPARTMENT.
- 8. Compartment cover (if cabin altitude is below 10,000 feet) CLOSE.

12.11.1.3 First Aid Oxygen

- 1. Oxygen compartment PULL COVER TO OPEN.
- 2. ON/OFF valve ON.
- 3. Mask DON.

To discontinue use:

- 4. ON/OFF valve OFF.
- 5. Mask RETURN TO COMPARTMENT.
- 6. Compartment cover CLOSE.

12.11.2 Pressurization Loss [CABIN ALT HI]

- *1. Helmet(s) Remove (as required).
- *2. Oxygen mask(s) DON.
- *3. Mask selector switch EMERG.
- *4. Mic switch(es) OXY.
- *5. Speaker switch(es) As required.
- *6. Passenger manual drop-out PULL ON, [PASS OXYGEN ON] ILLUMINATED.
- *7. Descend AS REQUIRED.
- 8. Passengers PULL LANYARD PIN, DON MASK.



The highest recommended cabin altitude for sustained flight is 25,000 feet.

- 9. Range DETERMINE FOR FINAL CRUISE ALTITUDE.
- 10. Oxygen duration CONFIRM (refer to Oxygen Duration, paragraph 7.3.1).

12.11.3 High Differential Pressure [CABIN DIFF HI]

- *1. Bleed air valves ENVIR OFF.
- *2. Oxygen (crew and passengers) AS REQUIRED.

*3. Descend — AS REQUIRED.

12.11.4 Auto-Deployment Oxygen System Failure

For auto-deployment oxygen system failure with [CABIN ALT HI] illuminated, [PASS OXYGEN ON] extinguished:

- *1. Passenger manual drop-out PULL ON.
- 2. First aid mask (if required) DEPLOY MANUALLY.

To isolate oxygen supply to the crew and first aid mask:

- 3. OXY CONTROL circuit breaker PULL.
- 4. Passenger manual drop-out PUSH OFF.

12.11.5 Bleed Air Fail [L BLEED FAIL] or [R BLEED FAIL]

The BLEED FAIL annunciator should be monitored during the engine start procedure. Either engine will extinguish both annunciators upon starting.

Illumination of an annunciator in flight indicates a possible rupture of a bleed air line aft of the engine firewall.

*1. Bleed air valve (affected engine) — PNEU & ENVIR OFF [L BLEED FAIL] or [R BLEED FAIL] — ILLUMINATED.

Note

The BLEED FAIL annunciator will not extinguish after closing the Bleed Air Valve.

- 2. ECS mode MAN HEAT.
- 3. MAN temp FULL DECREASE (30 seconds) then INCREASE as REQ'D.
- 4. Cockpit/Cabin blower AS REQUIRED.
- 5. Engine instruments MONITOR.

Note

BLEED FAIL annunciators may momentarily illuminate during simultaneous wing boot and brake deice operation at low N_1 speeds. If annunciators immediately extinguish, they may be disregarded.

12.12 EMERGENCY EXIT

Escape hatch handle — PULL.

Note

This is a plug-type hatch that opens into the cabin. The hatch can either be set aside inside the cabin, or placed outside the cabin through the hatch opening.

The outside handle may be locked from the inside with the EXIT LOCK lever. The inside EXIT-PULL handle will unlatch the door regardless of the position of the EXIT LOCK lever. Before flight, make certain the lock lever is in the unlocked position.

12.13 SPINS

Intentional spins are prohibited. If an unintentional spin is encountered, perform the following procedure IMMEDIATELY – THE LONGER THE DELAY, THE MORE DIFFICULT RECOVERY WILL BECOME. Steps

- 1. through 3. should be done AGGRESSIVELY and SIMULTANEOUSLY. The full forward position of the control column may be reduced slightly, if required, to prevent the airplane from exceeding a 90° nose down (inverted) attitude.
 - *1. Control column FULL FORWARD, AILERONS NEUTRAL.
 - *2. Full rudder OPPOSITE THE DIRECTION OF SPIN.
 - *3. Power levers IDLE.
 - *4. Rudder NEUTRALIZE WHEN ROTATION STOPS.
 - *5. Execute a smooth pullout.

Note

The Federal Aviation Administration does not recommend the spin-testing of multi-engine airplanes. The recovery technique presented above is based upon the best available information, but shall not be construed as any assurance that the airplane can, in fact, be recovered from a spin. In accordance with industry practice, no spin tests have been conducted on this airplane.

12.14 FLIGHT CONTROLS

12.14.1 Unscheduled Electric Pitch Trim Activation

- *1. Airplane attitude MAINTAIN USING ELEVATOR CONTROL.
- *2. A/P/Trim disconnect DEPRESS FULLY & HOLD, [TRIM] ILLUMINATED.

Note

Autopilot will disengage and Rudder Boost will be interrupted when the disconnect switch is depressed.

- 3. Manually retrim airplane.
- 4. A/P/Trim disconnect RELEASE.

If trim continues to run:

- 5. A/P/Trim disconnect DEPRESS FULLY & HOLD [TRIM] ILLUMINATED.
- 6. Pitch trim circuit breaker PULL.
- 7. A/P/Trim disconnect RELEASE.
- 8. Manually retrim airplane.
- 9. Autopilot DO NOT ENGAGE.

12.14.2 Unscheduled Rudder Boost Activation

Rudder boost operation without a large variation of power between the engines indicates a failure of the system.

- *1. AP/Trim disconnect DEPRESS TO 1ST LEVEL AND HOLD.
- *2. Rudder boost OFF.

If condition persists:

*3. YD/AP DISC (on Flight Guidance Panel) — PULL DOWN.

Note

Autopilot and Yaw Damper functions will not be available with the YD/AP Disconnect switch in the down position.

4. Perform normal landing.

12.15 AVIONICS

12.15.1 Autopilot Malfunction Altitude Losses

- 1. Climb 100 FEET.
- 2. Cruise 200 FEET.
- 3. Descent 300 FEET.
- 4. Non-Precision approach (one or two engines) 75 FEET.
- 5. Precision approach (one or two engines) 58 FEET.

12.15.2 Autopilot Failures

12.15.2.1 Autopilot Mistrim [E] or [A]

Illumination of a red-boxed E (Elevator) or A (Aileron) annunciator on the PFDs indicates the autopilot is flying the airplane in a mistrimmed condition.



Intentional or automatic disengagement of the autopilot without restraining the control wheel during a mistrim condition will produce a significant airplane response in the direction of the mistrim force.

If a mistrim indication continues for more than a few seconds:

- *1. Flight controls— HOLD FIRMLY (Control forces may exceed 25 pounds).
- *2. A/P DISENGAGE.
- 3. Retrim airplane if necessary.
- 4. Fuel balance CHECK (Rebalance if required).
- 5. A/P AS REQUIRED.

12.15.2.2 Autopilot Trim Fail [Trim]

Illumination of a red TRIM annunciation on the PFDs indicates that the autopilot pitch trim system has failed. The autopilot will not automatically disengage, but it may not function properly.

Note

A mistrimmed condition may occur in conjunction with the pitch trim failure. When the autopilot is disengaged in a mistrimmed condition, expect an abrupt change in control force.

- *1. Flight controls— HOLD FIRMLY.
- *2. A/P DISENGAGE.
- 3. Retrim airplane if necessary.

4. A/P—REENGAGE (if desired) (A/P will reengage & TRIM annunciator will extinguish if fault is cleared).

12.15.2.3 Autopilot Manual Disengagement

A manual autopilot disengagement will initiate an aural tone of approximately 2 seconds duration. The red AP failure flag on the PFDs will blink several times and then extinguish.

The autopilot can be manually disengaged by:

- 1. Pushing the AP/TRIM disconnect switch on either control wheel (Yaw Damper will disengage).
- 2. Pushing the Go-Around button on the left power lever. (Yaw Damper remains engaged).
- 3. Actuation of either control wheel trim switch (Yaw Damper remains engaged).
- 4. Pushing the AP button on the Flight Guidance Panel (Yaw Damper remains engaged).
- 5. Lowering the YD/AP DISC bar on the Flight Guidance Panel (Yaw Damper will disengage).

12.15.2.4 Autopilot Automatic Disengagement

An automatic autopilot disengagement will initiate a continuous aural tone and a blinking red AP failure flag on the PFDs which will become steady after 5 seconds. The aural tone and failure flag may be cancelled using any one of the following procedures:

- 1. Pressing the AP/TRIM disconnect switch.
- 2. Pressing the Go-Around button.
- 3. Activating the trim switch on the control wheel.

An automatic autopilot disengagement may be caused by any one of the following conditions:

- 1. A failure condition is detected by the Flight Guidance Computer.
- 2. A stall condition is detected by the stall warning system.
- 3. Extreme attitude limits are exceeded (60° in roll, 30° pitch up, 20° pitch down).

If An Automatic Disengagement Occurs:

- *1. Maintain airplane control.
- *2. AP/TRIM disconnect DEPRESS TO 1ST LEVEL TO CANCEL HORN.
- 3. Determine cause of disengagement.
- 4. A/P and YD AS REQUIRED.

12.15.3 Flight Display Failure Flags

The following failure flags are available for display on the PFD. The flags will appear flashing red for 5 seconds and then remain illuminated.

In the following steps, # is 1 when referencing the pilot's side and 2 when referencing the copilot's side.

ALT

This annunciation indicates invalid altitude data from the ADC. The altitude tape and digital thousands readout are removed.

ADC Switch — SELECT OPERATIVE ADC.

AP

This annunciator indicates an automatic disengagement of the AP. It will also display momentarily during a manual disengagement of the autopilot.

ATT

This annunciation indicates failure of the attitude data from the selected AHRS. The attitude display is removed.

AHRS Switch — SELECT OPERATIVE AHRS.

DCP

This annunciation indicates failure of the respective display control panel. Display format, selected navigation and bearing sources remain unaffected, but control of the respective display is lost.

No in-flight action required.

FD

This annunciation indicates the flight director has failed. If coupled to the failed flight director, the autopilot will also disengage. If only one PFD is affected, flight director and autopilot functions may be regained by transferring control to the operative side.

FMS#

This annunciation indicates the selected FMS navigation data is invalid. The course pointer, lateral deviation bar and to/from pointer are removed.

Nav source — SELECT ANOTHER SOURCE.

G/S

This annunciation indicates that glideslope data is invalid and the glideslope pointer is removed.

If glideslope data is valid on the other PFD, the approach should be flown by referencing the operable side, or selecting the operable nav source.

HDG

This annunciation indicates invalid heading data from the selected source. The compass rose/arc will rotate to north up.

AHRS switch — SELECT OPERATIVE AHRS.

IAS

This annunciation indicates invalid airspeed data from the selected ADC. The airspeed readout and scale are removed.

ADC switch — SELECT OPERATIVE ADC.

LOC#

This annunciation indicates the selected localizer data is invalid. The course pointer and lateral deviation bar are removed. If localizer data is valid on the other PFD, the approach should be flown by referencing the operable side, or selecting the operable nav source.

RA

This annunciation indicates the radio altitude data is invalid. The radio altitude digital display, radio minimums functions and the analog radio altitude display on the PFD will be inoperable. TAWS+ function will continue, but, certain features will be inoperative. TCAS II will be inoperative.

VOR#

This annunciation indicates the selected VOR data is invalid. The course pointer, lateral deviation bar and to/from pointer are removed. If VOR data is valid on the other PFD, continue flight by referencing the operable side, or selecting the operable VOR source.

VS

This annunciation indicates invalid vertical speed data from the selected ADC. The vertical speed pointer, scale and digital readout are removed.

ADC switch — SELECT OPERATIVE ADC.

VNV

This annunciation indicates invalid VNAV data. The VNAV deviation pointer is removed.

No in-flight action required.

12.16 TERRAIN AWARENESS AND WARNING SYSTEM PLUS (TAWS+)

TAWS+ WARNING (Red pull up message on PFD and Continuous "PULL UP, PULL UP" Voice Warning)

 O_1

TAWS+ TERRAIN WARNING (Red pull up message on PFD and "TERRAIN, TERRAIN, PULL UP" or "OBSTACLE, OBSTACLE, PULL UP" Voice Warning)

Note

- Pilots are authorized to deviate from their current air traffic control (ATC) clearance to the extent necessary to comply with a TAWS+ warning.
- In the event of a terrain warning, the MFD will automatically switch to display terrain. If not displaying terrain, the pilot's PFD and the MFD will auto range to 10 miles.

In IMC or at Night:

- *1. Autopilot DISCONNECT.
- *2. Wings LEVEL.
- *3. Power MAX ALLOWABLE.
- *4. Pitch INCREASE.
 - *a. Promptly and smoothly increase pitch towards an initial pitch attitude of 20° to 25°.
 - *b. Adjust as required to avoid continuous buffeting and/or stall warning.
 - *c. Adjust to maintain 135 KIAS.
- *5. Gear and flaps UP.
- 6. Continue climb at 135 KIAS until all visual and voice warnings cease.
- 7. ATC NOTIFY (if required).

In Day VMC:

- 1. Evaluate flight path with respect to Terrain.
- 2. Take action as necessary to recover safe terrain clearance.
- 3. Advise air traffic control as necessary.

12.16.1 Deactivation

If the pilot in command determines that activation of the TAWS+ will interfere in dealing with emergency conditions, the system may be deactivated by pulling the TAWS circuit breaker located on the right circuit breaker panel.

12.16.2 Ditching or Off-Airport Landing

Inhibit the visual and voice alerts using the following procedure.

TERR INHIB — SELECT.

12.17 SINGLE ADC FAILURE

- 1. ADC circuit breaker CHECK.
- 2. ADC switch SELECT OPERATIVE ADC.
 - a. The autopilot will revert to and continue to function in basic roll/pitch modes.
 - b. ADC comparators will be inoperative.
 - c. Couple FGC to the operating side ADC to re-engage autopilot.
 - d. If ADC 1 fails, transponders automatically obtain altitude data from ADC 2.

12.18 DUAL ADC FAILURE

ADC circuit breakers — CHECK.

Use electronic standby instrument system and land at the nearest suitable airport.

- 1. TCAS will be inoperative.
- 2. Transponder mode C will be inoperative.
- 3. Autopilot and yaw damper will be inoperative.

12.19 SINGLE AHRS FAILURE

- 1. AHRS circuit breaker CHECK.
- 2. AHRS switch SELECT OPERATIVE AHRS.
 - a. The autopilot and yaw damper will disconnect and will no longer function.
 - b. TCAS traffic will be displayed, but relative bearing to the displayed targets may not be accurate.
 - c. Weather radar stabilization will be inoperative.
 - d. AHRS comparators will be inoperative.

12.20 DUAL AHRS FAILURE

AHRS circuit breakers — CHECK.

Use Electronic Standby Instrument System and land at the nearest suitable airport.

- 1. The autopilot and yaw damper will disconnect and will no longer function.
- 2. TCAS traffic will be displayed, but relative bearing to the displayed targets may not be accurate.
- 3. Weather radar stabilization will be inoperative.

12.21 ELECTRIC PITCH TRIM INOPERATIVE [TRIM]

- 1. Airplane attitude MAINTAIN USING ELEVATOR CONTROL.
- 2. AP/TRIM disconnect DEPRESS TO 2nd LEVEL & RELEASE, [TRIM] EXTINGUISHED.

Note

Autopilot will disengage and Rudder Boost will be interrupted when the disconnect switch is depressed.

If [TRIM] remains illuminated:

- 3. Pitch Trim circuit breaker PULL.
- 4. Manually trim airplane.

CHAPTER 13

Abnormal Procedures

Note

- All airspeeds quoted in this section are indicated airspeeds (IAS) and assume zero instrument error.
- Closed [BRACKETS] in this section denote annunciator(s).

13.1 NO LIGHT START

If no ITT rise is observed within 10 seconds after moving the Condition Lever to LOW IDLE:

- 1. Condition lever FUEL CUTOFF.
- 2. Ignition and engine start OFF.
- 3. Allow 5 minutes for fuel to drain and starter to cool, then follow the ENGINE CLEARING procedure.

13.2 ENGINE CLEARING

The following procedure is used to clear an engine any time it is deemed necessary to remove internally trapped fuel and vapor, or if there is evidence of a fire within the engine. Air passing through the engine serves to purge fuel, vapor, or fire from the combustion section, gas generator turbine, power turbines and exhaust system.

- 1. Condition Lever FUEL CUTOFF.
- 2. Ignition and engine start starter only (for a maximum of 30 seconds).



Do not exceed the starter limits; see Chapter 4, Operating Limitations.

- 3. Ignition and Engine Start OFF.
- 4. Allow 5 minutes before attempting another start.

13.3 AIR START



The pilot should determine the reason for engine failure before attempting an air start. Do not attempt an air start if N_1 indicates zero.

13.3.1 Starter Assist (Propeller Feathered Or Windmilling)

CAUTION

Air starts may not be possible above 30,000 feet. Descend to a lower altitude if necessary. Above 20,000 feet, starts tend to be hotter. During engine acceleration to idle speed, it may become necessary to move the condition lever periodically into FUEL CUTOFF in order to avoid an overtemp condition.

- 1. ECS Mode OFF.
- 2. Cockpit/Cabin Blower AUTO.
- 3. Bleed Air Valve (inoperative engine) ENVIR OFF.
- 4. Radar STANDBY or OFF.
- 5. Furnishings OFF.
- 6. Power Lever IDLE.
- 7. Prop Lever LOW RPM.
- 8. Condition Lever FUEL CUTOFF.
- 9. Firewall Fuel Valve OPEN, [EXTINGUISHER PUSH] & [CLOSED] EXTINGUISHED.

CAUTION

If conditions permit, retard operative engine ITT to 700 °C or less to reduce the possibility of exceeding ITT limit. Reduce electrical load to minimum consistent with flight conditions.

- 10. Ignition and Engine Start ON, [IGNITION ON] ILLUMINATED.
- 11. Condition Lever (10% N_1 or above) LOW IDLE.
- 12. ITT and N₁ MONITOR (1,000 °C maximum).
- 13. Ignition and Engine Start (N_1 above 50%) OFF.
- 14. Prop Lever AS REQUIRED.
- 15. Power Lever AS REQUIRED.
- 16. Generator RESET, THEN ON.
- 17. Engine Auto Ignition AS REQUIRED.
- 18. Electrical Equipment AS REQUIRED.
- 19. Cockpit/Cabin Blower AUTO.
- 20. Bleed Air Valve OPEN.
- 21. ECS Mode AUTO.

13.3.2 No Starter Assist (Propeller Feathered Or Windmilling)

1. Power Lever — IDLE.

- 2. Prop Lever:
 - a. For prop feathered airstarts LOW RPM.
 - b. For prop windmilling airstarts FULL FORWARD, CONFIRM 1,700 RPM.
- 3. Condition Lever FUEL CUTOFF.
- 4. Firewall Fuel Valve OPEN, [EXTINGUISHER PUSH] & [CLOSED] EXTINGUISHED.
- 5. Engine Anti-ice OFF.
- 6. Generator (inoperative engine) OFF.
- 7. Bleed Air Valve (inoperative engine) ENVIR OFF.
- 8. Airspeed 140 KNOTS MINIMUM.
- 9. Altitude BELOW 20,000 FEET.
- 10. Engine $N_1 10\%$ MINIMUM.

Note

N₁ may be increased by increasing airspeed.

- 11. Engine Auto-Ignition ARM, [IGNITION ON] ILLUMINATED.
- 12. Condition Lever LOW IDLE.
- 13. ITT and N₁ MONITOR (1,000 °C maximum).
- 14. Power (after ITT has peaked) AS REQUIRED.
- 15. Generator RESET, THEN ON.
- 16. Engine auto-ignition AS REQUIRED.
- 17. Bleed air valve ON.
- 18. Electrical equipment AS REQUIRED.

13.4 ENGINE WARNING TONES SYSTEM

The Engine Warning Tones System is advisory only; observe basic AFM limitation and procedures for engine anomalies:

AURAL ADVISORY	AURAL TONE	PILOT ACTION
Transient Tone (Caution)	Repetitive 430 Hz tone	1. Monitor engine parameters.
		Retard the appropriate engine power lever as necessary to maintain engine limits.
		If engine parameters are within limits, but tone is going off, depress the TRANSIENT MUTE pushbutton.
		Note
		If prop speed of 1,760 rpm activated the tone, it may indicate a primary governor failure. Refer to the appropriate AFM procedure for this condition.
Exceedance Tone	Repetitive 3,000 Hz	Monitor engine parameters.
(Warning)	tone	Retard the appropriate engine power lever as necessary to maintain engine limits.

13.5 LANDING

13.5.1 Flaps Up Landing

Flaps up landing distance and V_{REF}. Refer to A1-C12WA-NFM-200, Performance Data Supplement.

- 1. Approach Speed (V_{REF} + 25 knots) CONFIRM.
- 2. Pressurization CHECK.
- 3. Cabin sign FSB.
- 4. Autofeather ARM.
- 5. Flaps UP.

CAUTION

Do not silence the landing gear warning horn, since the flap actuated portion of the landing gear warning system will not be actuated during a flaps up landing.

- 6. Flap Override SELECT.
- 7. Landing Gear DOWN.
- 8. Exterior and Interior Lights AS REQUIRED.

Note

Under low visibility conditions, landing and taxi lights should be left off due to light reflections.

- 9. Radar AS REQUIRED.
- 10. Environmental Bleed Air LOW.
- 11. Surface Deice AS REQUIRED.

Note

If crosswind landing is anticipated, determine Crosswind Component. Refer to A1-C12WA-NFM-200, Performance Data Supplement. Immediately prior to touchdown, lower up-wind wing and align the fuselage with the runway by use of rudder. During rollout, hold aileron control into the wind and maintain directional control with rudder and brakes.

When landing assured:

- 12. Airspeed V_{REF} + 25 KNOTS.
- 13. Yaw Damp OFF.
- 14. Prop Levers FULL FORWARD.
- 15. Power Levers IDLE.

After touchdown:

- 16. Power Levers LIFT AND SELECT GROUND FINE.
- 17. Brakes AS REQUIRED.
- 18. MWS Control Indicator Switch OFF.

- 19. CMDS Digital Control Display Unit MODE Switch OFF.
- 20. CMDS Safety Pin INSTALL.

13.5.2 One-Engine-Inoperative Approach and Landing

- 1. For One-engine-inoperative approach and landing:
 - a. Approach Speed (V_{REF}) CONFIRM.
 - b. Pressurization CHECK.
 - c. Cabin Sign FSB.
 - d. Fuel Balance CHECK.
 - e. Radar AS REQUIRED.
 - f. Environmental Bleed Air LOW.
 - g. Surface Deice AS REQUIRED.
 - h. Flaps APPROACH.
 - i. Landing Gear DOWN.
 - j. Exterior and Interior Lights AS REQUIRED.
 - k. Prop Lever FULL FORWARD.
 - 1. Airspeed 135 KNOTS.
- 2. When it is certain there is no possibility of go-around:
 - a. Flaps DOWN.
 - b. Airspeed V_{REF}.
 - c. Execute normal landing.

WARNING

Care must be exercised when using single-engine ground fine on surfaces with reduced traction. Do not use reverse thrust with one engine inoperative.

Note

Single-engine landing distances may be greater than normal landing distance. Refer to Landing Distance — One-Engine-Inoperative — Flaps Down graph in A1-C12WA-NFM-200, Performance Data Supplement, for single-engine landing distances.

13.5.3 One-Engine-Inoperative Go-Around

For one-engine-inoperative go-around:

- 1. Power MAXIMUM ALLOWABLE.
- 2. Landing Gear UP.
- 3. Airspeed INCREASE TO 135 KNOTS.
- 4. Flaps UP.

13.5.4 Propeller Ground Idle Stop Solenoid Failure

For propeller ground idle stop solenoid failure [PROP GND SOL]:

- 1. PROP GOV TEST Circuit Breaker PULL.
- 2. [PROP GND SOL] Extinguished FLY A NORMAL APPROACH. PLAN ON SLIGHTLY LONGER LANDING DISTANCES.

CAUTION

If the PROP GND SOL annunciator does not extinguish, the pitch of one or both propellers will decrease to the ground idle low pitch stop as power and airspeed are reduced during the approach to landing, causing an increase in drag and possible yawing of the airplane.

3. [PROP GND SOL] Illuminated — FLY A SHALLOW, POWER ON APPROACH AT 1,450 RPM. DO NOT REDUCE POWER UNTIL IN THE FLARE. PLAN ON SLIGHTLY LONGER LANDING DISTANCES.

13.6 SYSTEMS

13.6.1 Engine Oil System

13.6.1.1 Low Oil Pressure Indication (60 – 90 psi, Yellow Indication)

- 1. Do not exceed 62% torque.
- 2. Correct fault prior to next flight.

13.6.1.2 High Oil Pressure Indication (Above 135 psi, But Not Exceeding 200 psi)

Ground Operation, excluding transients during cold ground starts:

1. Correct fault prior to flight.

In Flight:

- 2. Continue flight to destination at pilot's discretion.
- 3. Correct fault prior to next flight.

13.6.1.3 Chip Detect [L CHIP DETECT] or [R CHIP DETECT]

- 1. Engine Instruments MONITOR.
- 2. If Abnormal SHUT DOWN ENGINE AT PILOT'S DISCRETION.

13.6.2 Fuel System

13.6.2.1 Crossfeed (One-Engine-Inoperative Operation)

For crossfeed with one-engine-inoperative operation:

- 1. Standby Pumps OFF.
- 2. XFR OVERRIDE Switches AUTO.
- 3. Fuel Crossfeed LEFT OR RIGHT (as required).
 - a. [FUEL CROSSFEED] ILLUMINATED.

b. [L FUEL PRES LO] & [R FUEL PRES LO] — EXTINGUISHED (annunciator will be illuminated on the inoperative engine side if the Firewall Fuel Valve is left closed).

WARNING

XFR OVERRIDE switch must be in AUTO position on side being crossfed. If the firewall fuel valve is closed, the supplemental fuel supply will not be available (usable), and the fuel pressure annunciator will remain illuminated on the side supplying fuel.

4. Fuel Quantity — MONITOR (max fuel imbalance — 300 lbs).

If supplemental fuel from inoperative side is required:

5. Firewall Fuel Valve (inoperative engine) — OPEN.

To discontinue crossfeed:

6. Fuel Crossfeed — OFF.

13.6.2.2 No Fuel Transfer [L NO FUEL XFR] or [R NO FUEL XFR]

If supplemental fuel is being supplied from extended range fuel tank:

1. XFR OVERRIDE Switch (same side) — ER.

If supplemental fuel is being supplied from auxiliary fuel tank:

- 2. XFR OVERRIDE Switch (same side) AUX.
- 3. Fuel Quantity MONITOR TO CONFIRM FUEL TRANSFER.

When Zero fuel is indicated in supplemental fuel tank:

4. XFR OVERRIDE Switch (same side) — AUTO.

Note

Failure to reposition XFR OVERRIDE switch from ER back to AUTO when the extended range fuel tank is empty will prevent transfer of fuel from auxiliary fuel tank. Instead, fuel will be supplied from the main fuel tank.

13.6.2.3 Fuel Quantity Low [L FUEL QTY] or [R FUEL QTY]

1. Fuel Quantity — CHECK.

If low fuel quantity is confirmed by fuel gage:

- 2. Standby Pump ON.
- 3. Fuel Quantity MONITOR.
- 4. Land NEAREST SUITABLE AIRPORT.

13.7 ELECTRICAL SYSTEM

13.7.1 Single Generator Failure [L DC GEN] or [R DC GEN]

1. Generator — RESET, THEN ON.

If generator will not reset:

2. Generator — OFF.

3. Electrical Load — MONITOR.

In the event of a single generator failure, electrical load should be less than the 300 amp capacity of a single generator. Therefore, the following systems may be shut off to reduce the electrical load below 300 amps:

- 1. Furnishing Systems.
- 2. Tail Flood Lights.
- 3. Prop Sync.
- 4. Copilot Windshield Anti-Ice.
- 5. Strobe Lights.
- 6. Cabin Lights.

13.7.2 Generator Tie Open [L GEN TIE OPEN] or [R GEN TIE OPEN]

1. Loadmeter (same side) — MONITOR.

If indication is appropriate:

2. Bus Sense Switch — RESET.

If greater than 100%:

- 3. Generator (same side) OFF.
- 4. Opposite Loadmeter MONITOR.

If Gen Tie will not reset:

5. Loadmeters — MONITOR.

13.7.3 Both Generator Ties Open [L GEN TIE OPEN] & [R GEN TIE OPEN]

- 1. Gen Ties MAN CLOSE [MAN TIES CLOSE] ILLUMINATED, [L GEN TIE OPEN] & [R GEN TIE OPEN] EXTINGUISHED.
- 2. If Gen Ties do not close:

Bus sense switch — RESET, [L GEN TIE OPEN] & [R GEN TIE OPEN] — EXTINGUISHED.

Note

If Gen Ties do not close, Center Bus will be powered only by the battery, eventually depleting the battery.

3. Center Bus Equipment — OFF (as required).

(Equipment powered by the Center Bus = Condenser Blower, Manual Prop Deice, Beacons, Ice Lights, Taxi Light, Landing Gear Motor.)

If battery is depleted:

4. Landing Gear — EXTEND MANUALLY.

13.7.4 Battery Tie Open [BAT TIE OPEN]

1. Center Bus Voltage — MONITOR.

If center bus voltage is normal (27.5 to 29 volts):

2. Bus Sense Switch — RESET, [BAT TIE OPEN] — EXTINGUISHED.

If center bus voltage is zero:

- 3. Gen Ties OPEN, [L GEN TIE OPEN] & [R GEN TIE OPEN] ILLUMINATED.

 (Equipment powered by the Center Bus = Condenser Blower, Manual Prop Deice, Beacons, Ice Lights, Taxi Light, Landing Gear Motor.)
- 4. Landing Gear Relay Circuit Breaker PULL.

Note

- · Battery will not charge.
- System powered by the center bus will not be operational.
- Landing gear will have to be manually extended.

13.7.5 Circuit Breaker Tripped

- 1. Nonessential Circuit DO NOT RESET IN FLIGHT.
- 2. Essential Circuit (necessary for continued safe flight):
 - a. Circuit Breaker (after allowing to cool for a minimum of 10 sec) PUSH TO RESET.

If circuit breaker trips again:

b. Circuit Breaker — DO NOT RESET.

13.8 FLIGHT CONTROLS

13.8.1 Yaw Damp/Rudder Boost System Inoperative

- 1. Descend to 5,000 feet MSL or below (if conditions permit).
- 2. Single engine rudder forces may exceed 150 lbs (68 kg).

13.9 LANDING GEAR SYSTEM

13.9.1 Hydraulic Fluid Low [HYD FLUID LOW]

If the [HYD FLUID LOW] illuminates during flight:

1. Landing Gear — ATTEMPT TO EXTEND NORMALLY UPON REACHING DESTINATION.

If landing gear fails to extend:

2. Follow Unsafe Gear Indications/Landing Gear Fails to Extend/Landing Gear Manual Extension procedures.

13.9.2 Landing Gear Fails to Retract/Unsafe Gear Indications/Landing Gear Fails to Extend/Landing Gear Manual Extension

If the landing gear fails to extend after placing the landing gear control down, perform the following:

- 1. Landing Gear Relay Circuit Breaker (Left Subpanel, Figure 2-4) PULL.
- 2. Landing Gear Control CONFIRM DN.
- 3. Alternate Extension Handle UNSTOW AND PUMP.
 - a. Pump handle up and down until the three green gear-down annunciators are illuminated.
- b. While pumping, do not lower handle to the level of the securing clip as this will result in loss of pressure.

If all three green gear-down annunciators are illuminated:

- 4. Alternate Extension Handle STOW.
- 5. Landing Gear Controls DO NOT ACTIVATE.

If one or more green gear-down annunciators do not illuminate for any reason and a decision is made to land in this condition:

- 6. Alternate Extension Handle CONTINUE PUMPING.
 - a. Continue to pump the handle until maximum resistance is felt.
 - b. When pumping is complete, leave handle at the top of the stroke. DO NOT LOWER AND STOW.

Prior to landing:

- 7. Alternate Extension Handle PUMP AGAIN.
 - a. Pump the handle again until maximum resistance is felt.
 - b. When pumping is complete, leave handle at the top of the stroke. DO NOT LOWER AND STOW.

After landing:

- 8. Alternate Extension Handle PUMP AGAIN WHEN CONDITIONS PERMIT.
 - a. Pump the handle again, when conditions permit, to maintain hydraulic pressure until the gear can be mechanically secured.
 - b. DO NOT STOW HANDLE.
 - c. DO NOT ACTIVATE THE LANDING GEAR CONTROL OR THE LANDING GEAR RELAY CIRCUIT BREAKER.
 - d. The landing gear should be considered UNLOCKED until the airplane is on jacks and the system has been cycled and checked.

13.10 ENVIRONMENTAL SYSTEMS

13.10.1 Duct Overtemperature [DUCT OVERTEMP]

- 1. ECS mode MAN HEAT.
- 2. Man Temp Incr/Decr DECR (30 seconds).

If condition persists:

3. Left Bleed Air Valve — ENVIR OFF.

If the [DUCT OVERTEMP] does not extinguish after 2 minutes:

- 4. Right Bleed Air Valve ENVIR OFF.
- 5. Oxygen AS REQUIRED.
- 6. Descend AS REQUIRED.

13.10.2 Electric Heat On [ELEC HEAT ON]

If the [ELEC HEAT ON] does not extinguish when ELEC HEAT is de-selected during ground operations:

1. ECS Mode — ELEC HEAT (initiate SHUTDOWN AND SECURE PROCEDURES when practical).

If the [ELEC HEAT ON] illuminates in flight and the ECS mode is in the ELEC HEAT Position:

2. ECS Mode — SELECT ANOTHER MODE.

If annunciator remains illuminated:

3. Cockpit Blower — HIGH.

4. Loadmeters — MONITOR.

Note

Turn off non-essential equipment as necessary to maintain loads within limits.

13.11 ICE PROTECTION SYSTEMS

13.11.1 Electrothermal Propeller Deice (Auto System)

Abnormal readings on deice ammeter (normal operation: 26 to 32 amps):

- 1. Zero amps:
 - a. Automatic Prop Deice CHECK, ON.
 - b. If OFF, reposition to ON after 30 seconds.
 - c. If ON with zero amps reading, system is inoperative; position the switch to OFF.
 - d. Use manual backup system.
- 2. Below 26 amps:
 - a. Continue operation.
 - b. If propeller imbalance occurs, increase rpm briefly to aid in ice removal.
- 3. Over 32 amps:
 - a. If the Auto Prop Deice circuit breaker switch does not trip, continue operation.
 - b. If propeller imbalance occurs, increase rpm briefly to aid in ice removal.
 - c. If the Auto Prop Deice circuit breaker switch trips, use manual system. Monitor loadmeters to ensure normal operation. (An approximate 10% increase on each meter is normal).
 - d. If the Prop Deice Control circuit breaker trips, or the loadmeters indicate the manual system is not working, (no increase or an excessive increase in current drain) avoid icing conditions. (Note: The Left and Right Manual Prop Deice control circuit breakers are not available to the pilot.)

13.11.2 Electrothermal Propeller Deice (Manual System)

- 1. Manual Prop Deice MANUAL FOR 90 SECONDS.
- 2. Loadmeters MONITOR FOR SMALL NEEDLE DEFLECTION (approx. 10%).
- 3. Repeat as required.

13.11.3 Engine Anti-ice Failure [L ENG ICE FAIL] or [R ENG ICE FAIL]

1. Engine Anti-ice Actuator — SELECT OTHER ACTUATOR.

If [ENG ICE FAIL] does not extinguish:

- 2. Exit icing conditions.
- 3. Assume Engine Anti-Ice is ON for performance calculations.

13.11.4 Surface Deice Failure

Note

Surface deice system failure is indicated by the failure of the WING DEICE and/or TAIL DEICE annunciators to illuminate when the SURFACE DEICE switch is activated, or extinguish after the appropriate cycle is completed.

1. Surface Deice — ATTEMPT MANUAL CYCLE.

If [WING DEICE] or [TAIL DEICE] do not illuminate, or if boot inflation cannot be confirmed visually:

- 2. Exit icing conditions.
- 3. Refer to A1-C12WA-NFM-200, Performance Data Supplement, for recommended landing approach speeds and performance with ice on the airplane.

WARNING

Intentional stalls are prohibited with a surface deice system failure and ice on the airplane.

13.11.5 Pitot-Static Mast Heat Failure [L PITOT HEAT] or [R PITOT HEAT]

Illumination of the L or R PITOT HEAT annunciator indicates that pitot mast heat is inoperative. The annunciator will also illuminate anytime the PITOT switch is in the OFF position.

13.11.6 Brake Deice

If operation does not automatically terminate approximately 10 minutes after gear retraction, system must be manually selected OFF.

If inadequate pneumatic pressure is developed for proper wing boot inflation, select brake deice system OFF.

13.12 STATIC AIR SYSTEM

13.12.1 Pilot's Alternate Static Air Source

The pilot's alternate static air source should be used for conditions when the normal static air source has been obstructed. When the airplane has been exposed to moisture, the possibility of obstructed static ports should be considered. Partial obstructions will result in the rate of climb indication being sluggish during a climb or descent. Verification of suspected obstruction is possible by switching to the alternate system and noting a sudden sustained change in the rate of climb. This may be accompanied by abnormal airspeed and altitude changes beyond normal calibration differences.

Whenever any obstruction exists in the normal static air system, or when the alternate static air system is desired for use:

- 1. Pilot's Static Air Source ALTERNATE.
- 2. For airspeed calibration and altimeter correction, Refer to A1-C12WA-NFM-200, Performance Data Supplement.

Note

Be certain the static air valve is in the NORMAL position when the alternate system is not needed.

13.13 CRACKED OR SHATTERED WINDSHIELD

The following procedure should be used when one or more cracks occur in the inner or outer ply of the windshield. The procedure is also applicable if the windshield shatters. This usually occurs in the inner ply and is characterized by a multitude of cracks which will likely obstruct the crew members vision and may produce small particles or flakes of glass that can break free of the windshield.

- 1. Altitude MAINTAIN 25,000 FT OR LESS, IF POSSIBLE.
- 2. Pressurization Controller RESET.
 - a. Cruise and Descent MAINTAIN A CABIN DIFFERENTIAL PRESSURE OF 2.0 TO 4.6 PSI.
 (A cabin differential pressure of 4.6 psi will produce approximately a 10,500-foot cabin altitude at an airplane altitude of 25,000 feet.)
 - b. Before Landing DEPRESSURIZE CABIN PRIOR TO TOUCHDOWN.
- 3. Other In-flight Considerations:
 - a. Visibility through a shattered windshield may be sufficiently reduced to dictate flying the airplane from the opposite side of the cockpit.
 - b. Precautions should be taken to prevent particles or flakes of glass from a shattered inner ply of the windshield from interfering with the crew's vision.
 - c. A cracked outer windshield ply may damage operating windshield wipers.
 - d. Windshield heat may be inoperative in the area of the crack(s).
 - e. The structural integrity of the windshield will be maintained.
- 4. Postflight considerations See Chapter 4, Operating Limitations.

13.14 CRACK IN ANY SIDE WINDOW (COCKPIT OR CABIN)

- 1. Altitude DESCEND IF REQUIRED.
 - a. Descend to an altitude not requiring oxygen, if possible.

or

- b. Descend to at least 25,000 feet if passengers are on board.
- 2. Crew and Passengers DON OXYGEN MASKS, IF REQUIRED.
- 3. Pressurization Controller RESET AS REQUIRED TO DEPRESSURIZE CABIN.
- 4. Cabin Pressure Switch DUMP.
- 5. Postflight Considerations See Chapter 4, Operating Limitations.

13.15 SEVERE ICING CONDITIONS (ALTERNATE METHOD OF COMPLIANCE WITH FAA AD 98-04-24)

The following weather conditions may be conducive to severe in-flight icing:

- 1. Visible rain at temperatures below 0 °C ambient air temperature.
- 2. Droplets that splash or splatter on impact at temperatures below 0 °C ambient air temperature.

13.15.1 Procedures for Exiting the Severe Icing Environment

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 °C, increased vigilance is warranted at temperatures

around freezing with visible moisture present. If the visual cues specified in Chapter 4, Operating Limitations for identifying severe icing conditions are observed, accomplish the following:

- 1. Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- 2. Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- 3. Do not engage the autopilot.
- 4. If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- 5. If an unusual roll response or uncommanded roll movement is observed, reduce the angle-of-attack.
- 6. Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- 7. If the flaps are extended, do not retract them until the airframe is clear of ice.
- 8. Report these weather conditions to Air Traffic Control.

13.16 AVIONICS

13.16.1 Avionics Master Power Switch Failure

If the avionics master pwr switch fails to operate in the ON position:

1. Avionics Master Circuit Breaker — PULL.

Note

Turning on the Avionics Master Power Switch removes power that holds the avionics relay open. If the switch fails to the OFF position, pulling the Avionics Master circuit breaker will remove power to the relay and should restore power to the avionics busses.

13.16.2 MFD (Multifunction Display) Failure

MFD failure will be presented as a blank MFD:

- 1. PILOT DISPLAY Switch SELECT PFD.
- 2. Engine information will be displayed at the top of the Pilot and Copilot PFD.

13.16.3 Pilot PFD (Primary Flight Display) Failure

Pilot PFD failure will be presented as a blank PFD:

- 1. PILOT DISPLAY Switch SELECT MFD.
- 2. Primary flight information will be displayed on the MFD.

13.16.4 TAWS+ Alert (Amber GND Prox Message on PFD and Voice Alert)

The following standard procedures (Figure 13-1) have been formulated to handle the majority of cases; however, it is the crew's responsibility to analyze all available instruments and information to determine the best course of action. ATC should be notified as necessary.

Figure 13-1. TAWS+ Mode, Voice Alerts, and Actions

MODE	VOICE ALERT	ACTION
1	"SINK RATE"	Level wings and reduce rate-of-descent until visual and voice alerts cease.
2	"TERRAIN, TERRAIN"	Immediately adjust flight path away from terrain.
3	"DON'T SINK, DON'T SINK"	Level wings and immediately establish a positive rate-of-climb.
4a	"TOO LOW GEAR"	Execute go-around if proper terrain clearance or landing gear position cannot be immediately verified.
4b	"TOO LOW FLAPS"	Execute go-around if proper terrain clearance or flap position cannot be immediately verified.
5	"GLIDESLOPE"	Immediately climb to re-establish proper glidepath or execute a go-around.
6	"BANK ANGLE, BANK ANGLE"	Reduce bank angle (There will be no amber GND PROX annunciator with the caution).

13.16.5 TAWS+ Mode Failure Messages

GPWS One or more of the basic GPWS modes (1-6) are inoperative and some or all of the

aural alerts and visual warnings and cautions may not be provided.

TERR CPA (Collision Prediction Alerting) mode is inoperative and associated aural alerts and

visual warnings and cautions may not be provided.

TERRAIN FAIL Terrain display is inoperative.

13.16.6 TAWS+ Terrain or Obstacle Alert (Amber GND PROX Message on PFD and "CAUTION TERRAIN, CAUTION TERRAIN" Voice Alert)

- 1. Stop descending, or climb, and/or turn as necessary, based on analysis of all available instruments and visual observations, in order to cancel the alert.
- 2. Advise Air Traffic Control as necessary.

13.16.7 GPS-FMS Disagree or GPS Not Available FMS Message

TERR INHIB — SELECT

Note

During Back Course Localizer only approaches, selecting G/S INHIBT will prevent nuisance G/S GPWS Alerts.

13.16.8 Single CDU Failure

1. CDU1 Circuit Breaker — CHECK.

If single FMS installed or L FMS/CDU1 failed:

2. CDU1/CDU2 Switch — SELECT CDU2.

13.16.9 3rd Trimble GPS Control

GPS-3 can be turned off with the POWER ON/OFF toggle switch located on the GPS No. 3 Control Panel located in the pedestal. FMS CDU indication will display GPS-3 as FAILED.

13.16.10 Dual CDU Failure

1. CDU1 and CDU2 Circuit Breakers — CHECK.

13.16.11 Dual FMS-3000 Flight Management Systems with 3rd Trimble GPS

The yellow MSG displayed on each PFD indicates presence of an FMS yellow message on the CDU that requires pilot awareness and may require pilot action. Refer to the Collins FMS-3000 Flight Management System Pilot's Operating Manual, under Messages and Annunciations, Section 15.

13.16.12 FMS Radio Tuning/Single FMS CDU Failure

The FMS Control Display Unit (CDUs) mounted in the pedestal are the radio tuning units. Should one of these CDUs become disabled the other may be used in place of the failed one. The "CDU 1", "NORM", CDU 2" which is located in the reversionary panel is used to present cross side information on the PFDs, i.e. "CDU 1" selected will cause FMS 1 data to be presented on both PFDs. In "NORM" position, FMS 1 data will be presented on the left PFD and FMS 2 data will be presented on the right PFD.

13.16.13 Dual FMS CDU Failure

- 1. CDU Circuit Breakers CHECK.
- 2. EMER 121.5 Freq Switch Select.

13.16.14 FMS Auto Tune Failure

A failure of the FMS to Auto Tune VOR and DME frequencies may be noted by one or more of the following indications:

- 1. The NAV frequencies are continuously cycling.
- 2. The NAV frequencies are failing to cycle to stations within a reasonable range of the airplane.
- 3. Display of the yellow VOR/FMS DISAGREE message on the CDU.

If a failure of the FMS auto tune function is detected:

1. CDU — SELECT MAN TUNING ON THE NAV CONTROL PAGE.

If the failure is not remedied:

- 2. Remote tune switch (on reversionary panel) SELECT DISABLE.
- 3. Select VOR 1 or VOR 2 for Navigation.

13.16.15 Single Audio System Failure

Audio Switch (affected side) — AUDIO ALTN.

13.16.16 Autopilot Mistrim [E] or [A]

Illumination of a yellow-boxed E (Elevator) or A (Aileron) annunciation on the PFDs indicates the autopilot is flying the airplane in a mistrimmed condition.

Note

Intentional or automatic disengagement of the autopilot without restraining the control wheel during a mistrim condition will produce a significant airplane response in the direction of the mistrim force.

If a mistrim indication continues for more than a few seconds:

1. Flight controls — HOLD FIRMLY (Control forces may exceed 15 pounds).

- 2. A/P DISENGAGE.
- 3. Retrim airplane if necessary.
- 4. Fuel balance CHECK (Rebalance if required).
- 5. A/P AS REQUIRED.

13.16.17 Miscompare Annunciators

Miscompare annunciators are displayed on the PFD to alert the pilot that redundant data from dual systems is not agreeing within limits. Attitude, heading, altitude and airspeed data are monitored full time. Full time comparators are provided for engine N₁, N₂, and ITT.

Miscompare annunciators are displayed in yellow, flashing for 5 seconds initially and then remain illuminated. The annunciators will extinguish when the miscompare condition is removed.

Two independent sources are required for each comparator function and the comparators are disabled if ADC or AHRS reversion is selected or either side has failed.

If miscompare annunciators are observed, the crew should attempt to ascertain which system/component is erroneous. Use of the Electronic Standby Instrument System may assist this process. The applicable reversionary mode for ADC or AHRS will provide cross-side data for display. No reversionary capability for engine miscompares is available.

13.16.17.1 ALT or IAS

These annunciators indicate a mismatch between the pilot's and copilot's displayed altitude or airspeed. This mismatch could be due to problems in one or more of the following systems: the pilot's ADC, the copilot's ADC, the pilot's pitot-static system, or the copilot's pitot-static system.

- 1. Establish airplane in straight and level, unaccelerated flight.
- 2. Compare pilot and copilot altitude and airspeed with those displayed on the Electronic Standby Instrument System. Note that the copilot's pitot-static system also serves the Electronic Standby Instrument System. Thus, an error in that pitot-static system will produce identical displays on the ESIS and the copilot's display.
- 3. Determine which air data computer or pitot-static system is in error. Problems in either pitot-static system may require slight climbs or descents to determine the faulty system.
- 4. Select the ADC for the side which is displaying the proper altitude and airspeed.

13.16.17.2 FD

This annunciation indicates a mismatch between the pilot's and copilot's flight director data, or pilot's and copilot's navigation source disagree.

- 1. A/P & YD DISENGAGE.
- 2. Determine navigation date matches couple side annunciation.
- 3. Continue the approach without use of the flight director if able. Otherwise execute a missed approach.

13.16.17.3 GS

This annunciation indicates a mismatch between the pilot's and copilot's displayed glideslope data.

- 1. Determine correct NAV source and select as necessary.
- 2. If unable to determine the correct source, proceed visually if able and either descend to localizer only minimums or execute a missed approach.

13.16.17.4 HDG

This annunciation indicates a mismatch between the pilot's and copilot's displayed heading data.

- 1. Establish airplane in straight and level, unaccelerated flight.
- 2. Compare indications with the Electronic Standby Instrument System.
- 3. Determine if pilot's or copilot's heading display is in error.
- 4. AHRS switch SELECT OPERATIVE AHRS.

13.16.17.5 LOC

This annunciation indicates a mismatch between the pilot's and copilot's displayed localizer data.

- 1. Determine correct NAV source and select as necessary.
- 2. If unable to determine the correct source, proceed visually if able or execute a missed approach.

13.16.17.6 N₁ or N₂ or ITT

This annunciation indicates a mismatch between the independent sources of engine data.

Power — If flight conditions warrant, reduce as required to maintain engine within limits.

13.16.17.7 PIT or ROL or ATT

This annunciation indicates a mismatch between the pilot's and copilot's displayed attitude data.

- 1. Establish airplane in straight and level, unaccelerated flight.
- 2. Compare indications with the Electronic Standby Instrument System.
- 3. Determine if pilot's or copilot's attitude is in error.
- 4. AHRS Switch SELECT OPERATIVE AHRS.

13.16.18 No Compare Annunciators

No compare annunciators are displayed on the PFD when compared parameters are valid, but no valid data is being received from a second source allowing the comparators to function (Figure 13-2).

No compare annunciators are displayed in white, flash for 5 seconds initially and then remain illuminated. They are extinguished when the no compare condition is removed.

No in-flight action is required.

Figure 13-2. No Compare Annunciators

COMPARATOR FUNCTION	NO COMPARE ANNUNCIATIONS
Heading	XAHS
Pitch	XAHS
Roll	XAHS
Pitch and Roll	XAHS
Altitude	XADC
Airspeed	XADC
Left N ₁ or N ₂ or ITT	ENG 1
Right N₁ or N₂ or ITT	ENG 2

13.16.18.1 Crosstalk Fail

A yellow boxed XTLK flag appears above the location of the ATT and IAS comparator flags on the PFD, and equivalent MFD location when applicable, when any flight display loses crosstalk input from any other PFD or MFD. The yellow boxed XTLK will be removed when communication is restored.

Displays that have been deselected by pilot reversion will not cause the yellow boxed XTLK flag to come into view.

13.16.19 AN/APX-119 IFF Transponder

If an amber "IFF" is displayed on the Caution/Advisory/Status panel when the IFF is selected, input the IFF code of the day. The system is not functioning as an "IFF" if the annunciator is illuminated.

Or,

ATC Reversionary Switch — ATC 1.

13.16.20 Modular Airborne Data Acquisition System (MADRAS)

If an amber [CVDR/FDR FAIL] light illuminates — Pull and reset CVDR circuit breaker once to see if light extinguishes.

13.16.21 Reduced Vertical Separation Minimum (RVSM) Airspace

13.16.21.1 General

Provides guidance to flight crews upon failure of RVSM-Critical aircraft systems during operations in RVSM airspace. These procedures may be conducted in conjunction with the established pilot contingency procedures for the RVSM airspace region.

13.16.21.2 Failure Of Pilot's ADC During RVSM Operation

A complete pilot's ADC failure during cruise would result in the loss of the pilot's independent altitude measuring system. If approved by ATC, flight in RVSM airspace may be continued upon pilot's ADC failure by implementing the following step-by step procedure:

- 1. Autopilot Altitude Hold Mode Disengage.
- 2. ADC Switch #2.

The copilot's air data system now provides information to both the pilot's and copilot's altitude displays.

- 3. Flight Guidance Couple Button COPILOT.
- 4. Autopilot Altitude Hold Mode RE-ENGAGE.
- 5. Altitude Reporting CHECK.

Ensure active transponder is still reporting valid altitude information to ATC.

6. Altitude Pre-selector/alerter — CHECK.

Ensure the altitude pre-selector/alerter is functioning properly. If necessary, cancel alert function and re-select desired altitude.

7. RVSM Abnormal (Pilot's ADC Fail) Checklist Completed.

Use the standby altimeter for hourly crosschecks with the copilot's altitude display to ensure the difference between the displayed altitudes does not drift during constant cruise operation. Note that the standby altimeter is NOT corrected for static source error and is NOT RVSM compliant.

13.16.21.3 Failure Of Copilot's Altitude Measuring System During RVSM Operation

A complete copilot's ADC failure during cruise would result in the loss of the copilot's independent altitude measuring system. If approved by ATC, flight in RVSM airspace may be continued upon copilot's ADC failure by implementing the following step-by-step procedure:

- 1. Autopilot Altitude Hold Mode DISENGAGE.
- 2. ADC Switch #1.

The pilot's air data system is now providing information to both the pilot's and copilot's altitude displays.

- 3. Flight Guidance Couple Button PILOT.
- 4. Autopilot Altitude Hold Button RE-ENGAGE.
- 5. Altitude Reporting CHECK.

Ensure active transponder is still reporting valid altitude information to ATC.

6. Altitude Pre-Selector/Alerter — CHECK.

Ensure the altitude pre-selector/alerter is functioning properly. If necessary, cancel alert function and re-select desired altitude.

7. RVSM Abnormal (Copilot's ADC Fail) Checklist Completed.

Use the standby altimeter for hourly cross-checks with the pilot's altimeter to ensure the difference between the two displayed altitudes does not drift during constant cruise operation. Note that the standby system is NOT corrected for static source error and is NOT RVSM compliant.

13.16.21.4 Inability Of Automatic Altitude Control System To Maintain ±65 Feet From Assigned Flight Level During RVSM Operation

If the automatic altitude control system cannot maintain an altitude within ± 65 feet of the desired flight level, disengage the altitude hold mode and ascend/descend (as appropriate) to the desired flight level. Re-engage the altitude hold mode and monitor the altitude hold performance. If the automatic altitude control system is unable to maintain the current flight level, follow the steps below:

- 1. Evaluate the aircraft's capability to maintain altitude through manual control.
- 2. Notify ATC of the failure and await ATC advisory.

13.16.21.5 Failure Of Automatic Altitude Control System During RVSM Operation

A complete failure of the automatic altitude control system will necessitate manual control of the airplane to maintain cruise flight level. If approved by ATC, flight in RVSM airspace may be continued by implementing the following step-by-step procedure:

- 1. Autopilot Altitude Hold DISENGAGE.
- Aircraft Altitude MAINTAIN MANUALLY.

Maintain the desired flight level using the pilot's or copilot's altitude displays as the altitude reference and adjust trim as required. Aircraft altitude must be carefully maintained while operating within RVSM airspace. Follow ATC advisories and notify ATC if the airplane cannot be maintained within ± 200 feet of the assigned altitude while in RVSM airspace.

3. RVSM Abnormal (Automatic Altitude Control System Failure) Checklist Completed.

PART VI

All-Weather Operation

Chapter 14 — Instrument Flight Procedures

Chapter 15 — Extreme Weather Operations

CHAPTER 14

Instrument Flight Procedures

14.1 GENERAL

Except for some repetition necessary for emphasis, clarity, or continuity of thought, this chapter contains only procedures that differ from or are in addition to those contained in Chapter 7, Shore-Based Procedures. All normal callouts are listed in Chapter 21, Flightcrew Coordination.

The UC-12W is a highly automated aircraft. The autoflight system is designed to reduce pilot workload and increase situational awareness. The autopilot and flight directors are tools to be used as the Aircraft Commander deems appropriate. When traffic and workload are light, hand flying is encouraged to maintain proficient flying skills. Use of the autopilot is highly encouraged in high traffic areas and in other situations where hand flying may cause increased workload on the non-flying pilot.

14.2 INSTRUMENT FLIGHT PROCEDURES

Flight handling, stability characteristics, and range are the same during instrument flight as during visual flight conditions.

14.2.1 Instrument Takeoff

Instrument takeoffs shall be accomplished in accordance with procedures established in Chapter 7, Shore-Based Procedures. The flight director command bars and runway heading should be selected on the flight director prior to commencing takeoff roll. Additionally, takeoff torque should be achieved prior to releasing brakes, i.e., perform a static takeoff.

14.2.2 Instrument Climb

Instrument climbs are performed by setting torque, as determined by the static takeoff power charts, not to exceed 785 °C ITT, and selecting either FLC or V/S mode on the flight director. The climb checks should be completed in accordance with Chapter 7, Shore-Based Procedures.

14.2.3 Instrument Cruise

Stability and flight characteristics are normal throughout the full speed range during instrument flight operations. Power settings will be determined by using the cruise power charts.

14.2.4 Instrument Descent

Instrument descents may be performed in one of three ways: FLC, V/S, or VNAV. Normally the descent will be made with the aircraft in the clean configuration, reducing power and maintaining cruise speed. Optimum fuel performance is obtained by remaining at altitude until reaching the point where idle power descent can be accomplished to the IAF. However ATC may not allow this type of descent in high traffic areas.

14.2.5 Instrument Approaches

The UC-12W is capable of flying numerous types of instrument approaches. These include ILS, VOR, VOR/DME, Localizer, Localizer Back Course, Localizer Directional Aid, Simplified Directional Facility, NDB, TACAN, Multi-Sensor RNAV, GPS, GPS overlay, ASR, and PAR approaches.

The following standard procedures are typical of what may be expected in the instrument environment. Occasionally deviations from these procedures may be required. Any deviation must be approved by the TPC and thoroughly briefed prior to commencing the approach.

14.2.5.1 ILS Approaches

ILS approaches may be flown in three ways: coupled, hand-flown with flight director, or hand-flown with raw data only. In any case, the ILS pattern should be flown in the same manner (Refer to Figure 14-1).

14.2.5.2 ILS Procedures

Load the ILS into the CDU and verify the points on the NAV page of the FMS.

The FMS will perform a NAV to NAV capture. When the FMS is the current active NAV source and has been loaded with a localizer based procedure, the FMS will automatically tune that localizer and setup a preselected course when within 30 nm of the airport. The transfer will happen automatically only if the APPR mode has been pressed and the preselected course is trending toward center.

Established on downwind (or approximately 15 miles from the airport for a straight-in approach) the aircraft should be slowed to 180 to 200 KIAS.

Turning to base leg, select flaps to Approach and slow to 150 to 180 KIAS. This speed should be maintained until established on the localizer and approaching glideslope intercept.

On dog leg to final, cleared to intercept the localizer, select APPR mode on the FGP, ensure the automatic NAV to NAV capture procedure has occurred by confirming FMS 1 switches to LOC1 on the PFD.



APPR mode must be selected within 90° of FAC for an ILS or LOC approach to prevent FMS logic from tracking a back course.

Prior to commencing the final approach segment, ensure aircraft is fully configured for landing.

Slow to briefed approach speed, 135 knots. If not already accomplished, the missed approach altitude should be set in the ALT window. Fly the aircraft on glideslope, on localizer, and on speed making standard callouts, in accordance with Chapter 21, Flightcrew Coordination, to the Decision Altitude (DA). At DA, continue to landing if required visual cues are present or initiate a missed approach if the required visual cues are not present.

14.2.5.2.1 Back Course (BC) Approach

Load the LOC BC into the CDU and verify the points on the NAV page of the FMS.

Refer to paragraph 14.2.5.2, ILS Procedures for all remaining procedures.



APPR mode must be selected within 70° of FAC for a LOC BC approach to prevent FMS logic from tracking a LOC front course.

14.2.5.3 PAR Approaches

Like the ILS, the PAR may be flown coupled, hand-flown with flight director, or hand-flown with raw data only. The pattern will be identical to the ILS pattern with regard to speeds and configurations. Normally, the Pilot Not Flying (PNF) should make all heading changes and vertical speed adjustments based on the final controller and PF directions.

Note

Heading and vertical speed are the recommended modes to be used on a PAR with autopilot or flight director engaged.

At the PF's direction, the PNF shall select the landing gear down, flaps to DOWN. The aircraft is then slowed to the briefed approach speed. When on glideslope, begin descent at approximately 700 fpm, and set missed approach altitude in the ALT window of the PFD. Actual rate of descent required for a 3° glideslope may be determined by dividing the ground speed by 2 and adding a zero (example, 130 knots ground speed divided by 2 = 65, add a zero, = 650 fpm descent). Inside the FAF vertical speed should be limited to no more than 1,200 fpm.

The PAR approach should be flown on course, on glideslope and on speed making standard callouts to the Decision Height (DH). At DH, continue to landing if the required visual cues are present or initiate a missed approach if the required cues are not present.

14.2.5.3.1 Vertical Speed Procedure

The vertical speed procedure can be used on any non-precision approach, with three different sources of lateral guidance. Heading select may be used on any approach, but is the only method available for GCA approaches. It is also the primary method used on PAR approaches. LNAV is available for any approach that is line-selectable from the FMS database. Tracking a radio navaid (VOR, LOC, TACAN, or LOC BC) is the third source of lateral guidance. It is imperative that both pilots select the appropriate guidance on the nav source selector prior to commencing an approach.

The pattern and configuration schedule for a vertical speed-type non-precision approach is similar to that for the ILS and PAR approaches until approaching the FAF (Refer to Figure 14-2). On downwind leg, or approximately 15 miles out for a straight-in approach, slow to 180 to 200 KIAS. Turning to base leg, select flaps to Approach and slow to 150 to 180 KIAS. Maintain this speed and configuration until approaching the FAF.

Established on the final approach course and approximately 2 to 3 miles prior to the FAF, select gear down, flaps to land, and slow to briefed approach speed, 125 knots minimum. Approaching the FAF begin descent using vertical speed (no more than 1,200 fpm inside FAF) down to the MDA. All descents may be initiated 0.2 nm prior to the published or planned descent point.

Upon reaching the PDP/VDP with the required visual cues in sight, select vertical speed of 700 fpm, and set the missed approach altitude, and disengage autopilot (if engaged). If the aircraft is not lined up on the runway, the pilot should adjust heading as necessary to intercept runway centerline as soon as possible. The PNF should monitor vertical speed and airspeed, and call out any significant deviations once the PF has transitioned to a visual scan.

14.2.5.3.2 Vertical Navigation (VNAV)

Vertical Navigation (VNAV) is a function to ensure that altitude constraints at waypoints are honored, that speed constraints at waypoints and speed limits at altitudes are honored, and that the vertical flight profile as specified by the crew is followed.

When selected on the FGP, VNAV works in all vertical modes and is indicated to the crew by adding a V to the mode on the display (for example, VPTCH, VVS, VFLC). The crew has full command of pitch, vertical speed, FLC, altitude hold mode, and altitude hold mode and altitude preselect AP modes while VNAV is active. When VPTCH and VVS are the active modes and the aircraft is climbing, these modes will operate as normal. The aircraft will level at the preselector altitude and the VNAV altitudes from the FMS. When VPTCH and VVS are the active modes and the aircraft is descending, these modes will operate as normal, except not only will the aircraft level at the preselector altitude, but will also level at the VNAV altitudes from the FMS. It will also automatically switch to VPATH (vertical path) if it comes upon a path selected from the FMS. When VFLC is in the active mode, it will operate normally with the same constraints as VPTCH and VVS, but will also be capable of flying program speeds from the FMS. VPATH is the vertical path controlled by the FMS to maintain the desired GP. When NAV is the selected navigation source, the aircraft will level at the preselector altitude or the FMS VNAV altitude. VGP is a mode that was designed to let an FMS approach operate like a normal ILS approach. When APPR is the selected lateral mode, and the leg into the Final Approach Fix (FAF) or the Missed Approach Point (MAP) is the active leg, VGP will show as the active vertical mode and the aircraft will not level at the preselector altitude. This allows the crew to set the preselector to the missed approach altitude like an ILS approach when glideslope is the active vertical mode.

14.2.5.4 FMS Based Approaches

FMS non-precision based approaches are GPS, RNAV/GPS without VNAV, VOR, VOR/DME, TACAN (as a GPS overlay), NDB and Non-Precision Approach — VNAV. Refer to Figures 14-2 and 14-3. There are two different types of non-precision FMS approaches, RWY and V-MDA. The FMS is certified to do stand-alone GPS and multi-sensor non-precision approaches. Lateral and vertical guidance is displayed on the PFD. The lateral deviation bar and scale on the HSI give lateral guidance while the vertical deviation pointer and scale give vertical guidance.

Note

It is strongly recommended that the autopilot and flight directors be used when performing any non-Precision Approach if the ceiling is less than 1,000 feet, and/or the visibility is less than 3 statute miles, or if the reported ceiling and visibility are at published minimums (whichever is higher). Use of the auto flight system allows both pilot's to have higher situational awareness, and gives the best opportunity to see the required visual cues when breaking out at MDA/DA.

FMS approach logic is automatically enabled at 30 nm from the ARP (Airport Reference Point) at the destination and stays active until after the MAP (Missed Approach Point). To transition to a missed approach procedure, the approach must be disabled by any of the following actions:

Pushing the GA button.

Making a lateral change to the flight plan between the FAF and the MAP.

Manually sequencing through the flight plan past the MAP.

Delete the FAF or MAP.

Push the APPR ENABLED line key on the Arrival page to select NO.

If the TO waypoint is the MAP, select AUTO SEQUENCE.

14.2.5.5 RWY Approaches

Runway Approaches are those that have a VPA (Vertical Path Angle) in the database missed approach point. The VPA is usually the charted missed approach point. The annunciator RWY shows on the ACT LEGS page identifying this type of non-precision approach. The database missed approach point can be the runway or another waypoint. The VPA is specific for given approach and provides obstacle clearance down to the MDA. Runway waypoint VPA, shown on the LEGS page, cannot be deleted or changed. Vertical flight-path tracking is based on the aircraft's corrected barometric altimeter.

RWY Approaches can be flown two different ways. The first is the use of VNAV DA(H) in lieu of MDA(H) in which APPR mode is selected. The autopilot will display VGP to indicate the aircraft is being steered vertically to a pseudo-glide path. When in the VGP mode, the aircraft will continue descent through the preselected altitude. The second RWY Approach is selected by leaving the autopilot in the NAV mode when flying the approach and preselecting the MDA in the altitude window. In NAV mode, the VNAV mode will remain in VPATH instead of transitioning to VGP during the approach. The aircraft will now capture the preselected MDA altitude.

WARNING

- It is the pilot's responsibility to recognize when the aircraft reaches the MDA and make a decision on how to continue the approach. With the VNAV coupled to the autopilot and VGP is displayed in the FMA, the FMS will not level the aircraft at the MDA for RWY type approaches.
- With coupled VNAV capability, the VPA for a RWY type approach provides compliance with step-down fix altitude restrictions down to the MDA. It remains the pilot's responsibility to monitor for that compliance and intervene if necessary to prevent a descent through a step-down fix.



When FMS approach operations are done in the INDEP mode for dual installations, ensure that the flight plans on both sides are identical. When autopilot APPR mode is selected to arm the VGP mode, the autopilot APPR mode uncouples the flight directors, and the flight director on each side is driven by the applicable FMS. If the flight plans are not identical in the two FMS, the flight director indications will not agree, which is not acceptable during final approach.

Note

Some approaches have a published decision altitude (DA) that is lower than the normal MDA for the same approach. This lower DA can only be used if the approach is flown in LNAV and VNAV. These minima will be presented as LNAV/VNAV DA of the approach chart. This FMS is not certified for LPV minimums.

14.2.5.6 V-MDA Approaches

V-MDA Approaches are those that terminate at a missed approach point generally located somewhere other than at the runway threshold. V-MDA is annunciated in the ACT LEGS page to identify the type of non-precision approach, which includes circling approaches and approaches where the MAP is navaid located on the field.

Between the FAF and the MAP of a V-MDA approach, the FMS will not be able to guide the aircraft vertically using the autopilot VGP or VPATH modes. If the autopilot mode was either VGP or VPATH before the FAF, the autopilot mode will drop to VPTCH between FAF and the missed approach altitude. The NO VPATH CONDITION message will appear on the CDU to indicate that FMS VNAV guidance is no longer being provided.

WARNING

- The use of VNAV vertical guidance for a V-MDA type approach between the final approach fix and the missed approach fix is prohibited.
- It is the pilot's responsibility to recognize when the aircraft reaches the MDA and to make a decision on how to continue the approach. The FMA will capture the V-MDA for V-MDA type approaches in VPATH mode.
- If given approach has any step-down fixes between the FAF and arrival at the MDA, VNAV is not authorized and should not be used for this portion of the approach. The FMS does not recognize step-down fixes between the FAF and the MAP and will not comply with them. It is possible for FMS guidance to go below a step-down fix altitude restriction after the FAF.

14.2.5.7 GPS Approaches

To fly a GPS approach, or RNAV, VOR/DME, VOR, TACAN, or NDB approach as a GPS-overlay using the FMS, the approach must be selected and inserted into the flight plan. GPS and NDB approaches cannot be flown with the FMS if the GPS navigation sensor is not available. If flight director vertical steering guidance is desired, the preselector altitude must remain set below aircraft altitude past the leg into the FAF.

The FMS will sequence from the en route segment to the approach segment, the following will occur at 30 nm great circle distance from the ARP:

- 1. Shows the TERM message on the PFD.
- 2. Transitions from terminal deviation sensitivity ± 1.0 nm.
- 3. Monitors RAIM.

Between 2 nm away from the FAF up to the FAF, if approach is enabled and the FAF waypoint sequencing conditions are met, the system automatically:

- 1. Annunciates GPS APPR on the PFD.
- 2. Transitions to approach sensitivity of ± 0.3 nm.
- 3. Continuous monitoring of RAIM.

If approach is enabled and any of the following conditions are true, the NO APPR is shown in yellow on the PFD:

- 1. Approach RAIM is not available at any time while the aircraft is 2 nm inbound to the FAF.
- 2. Approach RAIM is available while the aircraft is between 2 nm inbound to the FAF and the FAF. The missed approach point is more than 5 minutes from the FAF, and approach RAIM is predicted to be unavailable within 5 minutes of predicted arrival time at the MAP.
- 3. Approach RAIM is not available at 2 nm inbound to the FAF and approach RAIM is predicted to be unavailable within 5 minutes of predicted arrival time at the FAF or MAP.
- 4. Approach RAIM is not available for 5 minutes during final approach.
- 5. GPS NOT AVAILABLE, NO APPR GPS RAIM, NO GPS RAIM, or FMS DR message is annunciated after 20 seconds while in final approach.

If any of these criteria are met, a mandatory go-around or missed approach must be executed.

14.2.5.8 RNAV Approaches

To fly an RNAV, VOR/DME, TACAN, or VOR approach as an RNAV approach with FMS, but without the GPS sensor, the approach must be selected and put in the flight plan.

The FMS will sequence from the en route segment to the approach segment, the following will occur at 30 nm great circle distance from the ARP.

- 1. Shows the TERM message on the PFD.
- 2. Transitions from terminal deviation sensitivity ± 1.0 nm.
- 3. Monitors RAIM.

Between 2 nm away from the FAF up to the FAF, if approach is enabled and the FAF waypoint sequencing conditions are met, the system automatically:

- 1. Annunciates GPS APPR on the PFD.
- 2. Transitions to approach sensitivity of ± 1.0 nm.

3. Continuous monitoring of RAIM.

Between the FAF and the MAP, the system automatically:

- 1. Shows APPR message on the PFD.
- 2. Maintains deviation sensitivity of ± 1.0 nm.
- 3. Continuous monitoring of RAIM.

Selection of an RNAV approach is done on the ARRIVAL page. RNAV approaches include a FAF, a MAP, and a missed approach procedure. The FMS automatically tunes the recommended navaid when within 30 nm from the arrival airport. If the recommended navaid is not tuned within 2 nm inbound to the FAF, NO APPR shows in yellow on the PFD, requiring a mandatory Missed Approach.

Establish inbound on the final approach course and approximately 2 to 3 nm prior to the FAF, configure to gear down, flaps to land, and slow to 125 knots minimum. Once cleared for the approach and if flying a RWY APPR to a DA, select APPR mode. If flying to an MDA, ensure NAV mode is selected. Anytime the AC is established on a published segment of the approach, VNAV can be selected to fly the final segment of the approach. In the APPR mode, MAP altitude can be set. If you are in NAV mode, MDA altitude must be captured first, then MAP altitude can be set.

At DA, if required visual cues are present, disengage the autopilot and land the aircraft or execute a missed approach if the required visual cues are not present.

14.2.5.9 Stabilized Approach Criteria

A stabilized approach is characterized by a constant-angle, constant-rate of descent approach profile ending near the touchdown point, where the landing maneuver begins. All appropriate briefings and checklist shall be accomplished before 1,000 ft HAT in instrument meteorological conditions (IMC) and before 500 ft HAT in visual meteorological conditions (VMC).

An Approach is stabilized when all of the following criteria are maintained from 1,000 HAT IMC (or 500 HAT in VMC) to landing in the touchdown zone:

- 1. Fully configured for landing.
- 2. On the proper flight path at the proper sink rate.
 - a. The rate of descent is no greater than 1,000 fpm.
 - b. If an expected rate of descent greater than 1,000 fpm is planned, a special approach briefing shall be performed.
 - c. If an unexpected, sustained rate of descent greater than 1,000 fpm is encountered during the approach, a missed approach shall be performed. A second approach may be attempted after a special approach briefing, if conditions permit.
- 3. At the briefed approach speed.
- 4. At the appropriate power setting for briefed approach speed.
- 5. If any of the stabilized approach requirements are not met, a MISSED APPROACH/GO-AROUND shall be executed.

14.2.5.10 Planned Descent Point

A planned descent point should be computed and briefed for all non-precision vertical speed-type approaches. If there is a published VDP, that defines the descent point from MDA. There are three ways to compute a PDP, in the event that there is no published VDP. If the runway is the "to" waypoint in the FMS, take the height above touchdown (HAT) at MDA (from the approach chart) and divide this by 300. The result is the distance in nm from the end of

the runway for a 3° glideslope. (For example: a 450 foot HAT divided by 300 = 1.5 nm from the end of the runway for a PDP). This is the most accurate method available.

If DME is the best information available, and the missed approach point (MAP) is co-located with the end of the runway, take the HAT from the approach chart and divide by 300. This is the distance from the MDA to the runway for a 3° glideslope, but needs to be converted to DME. (For example: The MDA is 700 feet, and HAT is 389 feet. Divide 389 by 300 for a PDP of 1.3 nm from the end of the runway. The runway is co-located with the missed approach point at 1.2 DME, so you add 1.3 and 1.2 to get a PDP of 2.5 DME).

If the only way to define the missed approach point is timing (and the MAP is co-located with the end of the runway), take the HAT at the MDA and divide by 10. Subtract the result from the missed approach timing to get a PDP. (For example: the MDA is 800 feet and the HAT is 487. Divide 487 by 10 to get an adjustment of 49 seconds. Subtract this from the MAP timing of 2:19 to get a PDP of 1:30). This is the least accurate method for determining a PDP, but it will give the crew a rough idea of when to commence the final descent to the runway.

Note

There is no reason to compute a PDP for a VNAV approach. The DA is the descent point, so the decision must be made at that point. If the required visual cues are present, continue below the DA and land. If the required visual cues are not present, a missed approach must be initiated.

14.2.5.11 Transition to Visual

At some point during all instrument approaches, the pilots must transition to a visual scan in order to complete the approach with a landing. As the aircraft approaches minimums (MDA, DA, or DH) the crew must begin to transition to an outside/visual scan. The recommended method is for the PNF to begin scanning outside as the aircraft approaches (approximately 100 feet above) minimums. If the runway environment is in sight he should call "Runway in sight" or "Lights in sight", with a clock-code direction (e.g., "runway in sight – 1 o'clock").

If after the PNF calls the runway environment in sight, the PF should briefly scan outside to confirm the required visual cues are in sight and other requirements for landing can be met (i.e., visual conditions can be maintained, aircraft can descend using normal maneuvers). If requirements can be maintained the PF shall respond "Landing", shall disengage the autopilot (if and when required), transition primarily to an outside visual scan, and continue to land. At the PF's "Landing" call, the PNF should return to an instrument scan to monitor for excessive deviations.

14.2.5.12 Missed Approach/Go-Around

During an instrument approach, if visual contact with the runway environment is not established upon reaching the missed approach point, execute a Go-Around and comply with missed approach instructions. Initially, the PF should add maximum allowable power, depress the Go-Around button to disengage the autopilot and transfer the flight director to go-around mode and initiate Missed Approach/Go-Around Procedure.

Speed should be 135 KIAS and flaps should be retracted at a minimum of blue line. Use Heading or Nav mode to fly the missed approach ground track as assigned by ATC. The PNF should call tower/ATC announcing a missed approach as soon as possible after the aircraft is clean and flying the appropriate missed approach instructions. Ensure the remaining items on the Climb checklist are completed after clean-up.

Wave-off or missed approach may be called for by either pilot or by ATC if an individual recognizes an unsafe condition or situation developing. When called for, the PF should initiate the maneuver described above.

14.3 NIGHT FLYING PROCEDURES

The same procedure used for instrument flying should be used when flying at night. During preflight, ensure that all interior and exterior lights are functioning properly. Adjust the display and console lights for comfortable vision, to ensure maximum visibility outside and at the same time allow the pilot to easily transition between visual and instrument flying.

Note

Landing/Rec-Taxi lights may be turned off at the PF's discretion if they reduce visibility, adversely affect depth perception or induce vertigo during approach/landing in haze, smoke or fog.

14.3.1 Night Landing

Night Landing procedures are the same as procedures used during a day landing. Instrument and interior light intensity should be kept as low as possible to aid night vision. Avoid using landing or rec/taxi lights in thick haze, smoke or fog, as reflected light from the particles in the air may reduce visibility.

Figure 14-1. ILS Approach (Typical)

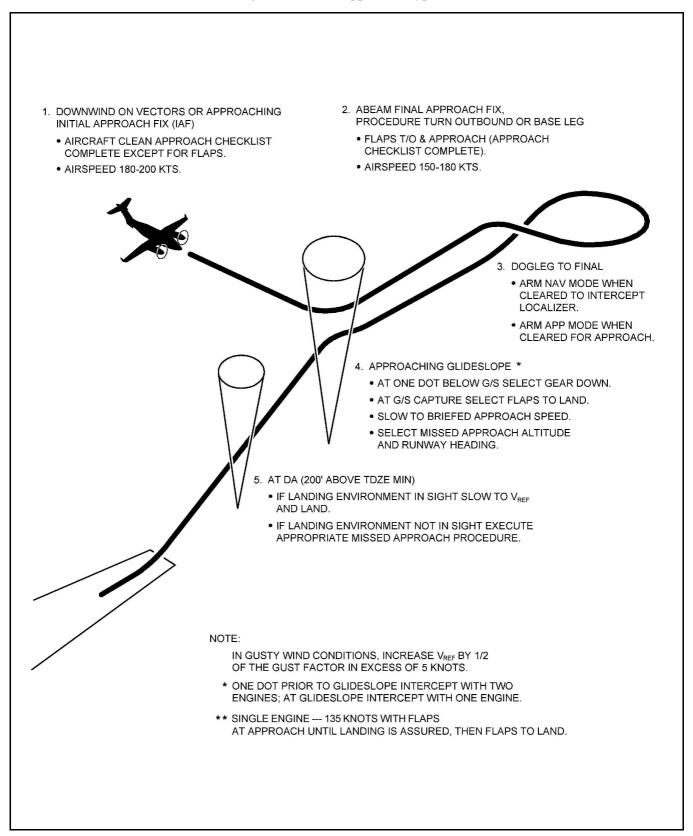


Figure 14-2. Non-precision Approach for VOR, TCN, NDB, RNAV/GPS (without VNAV)

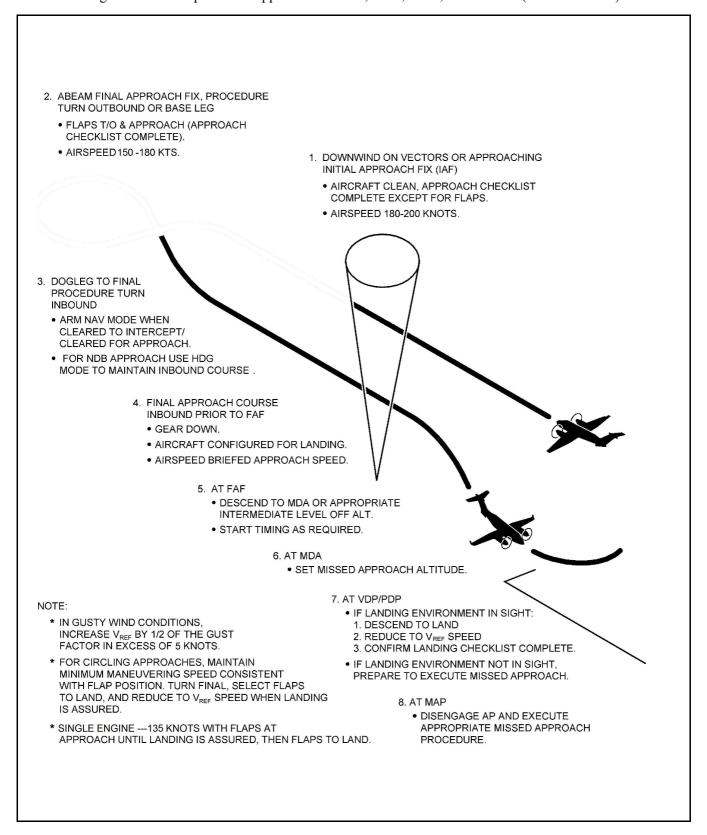


Figure 14-3. Non-precision Approach — VNAV

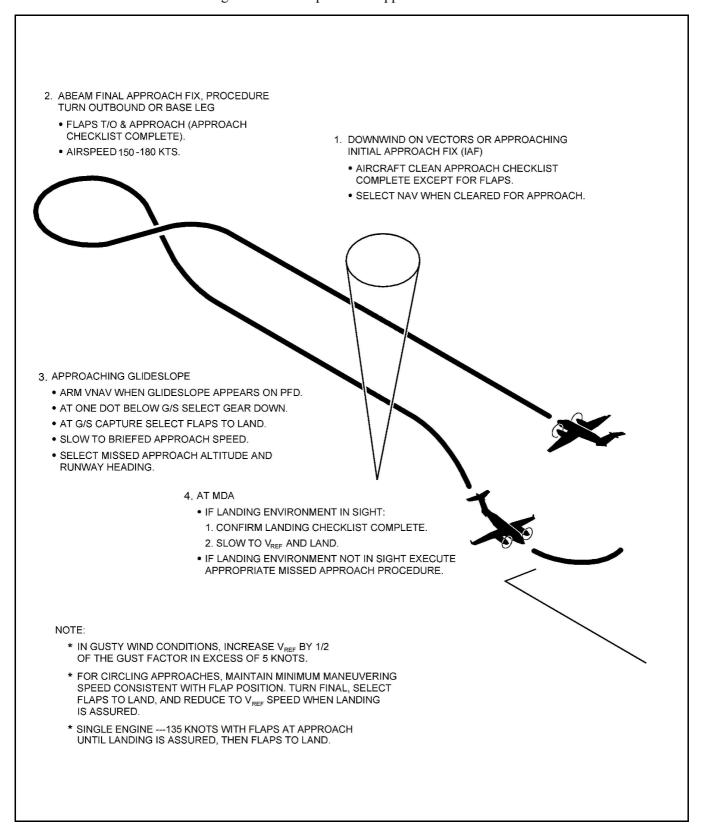


Figure 14-4. Normal Landing Pattern

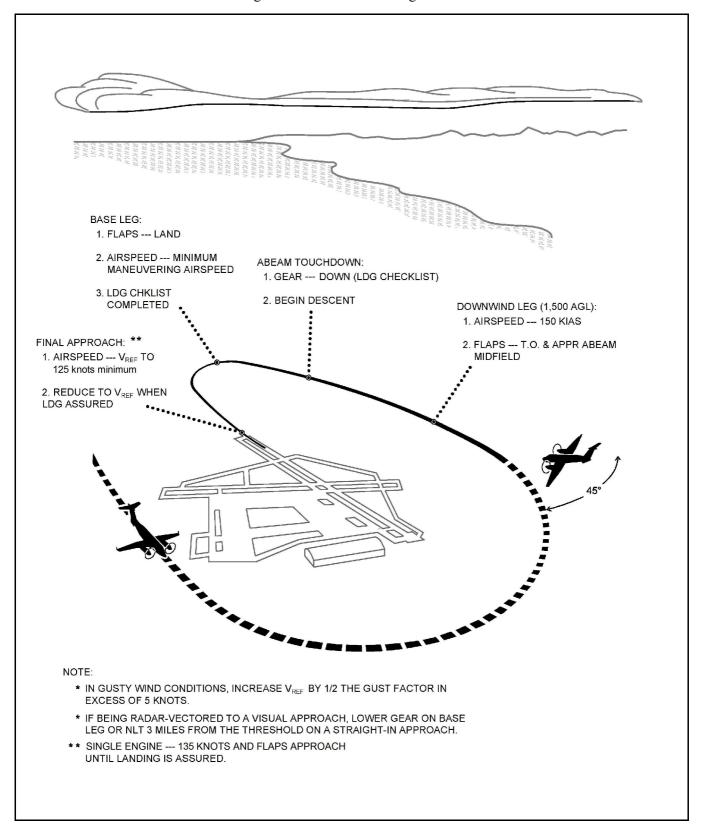
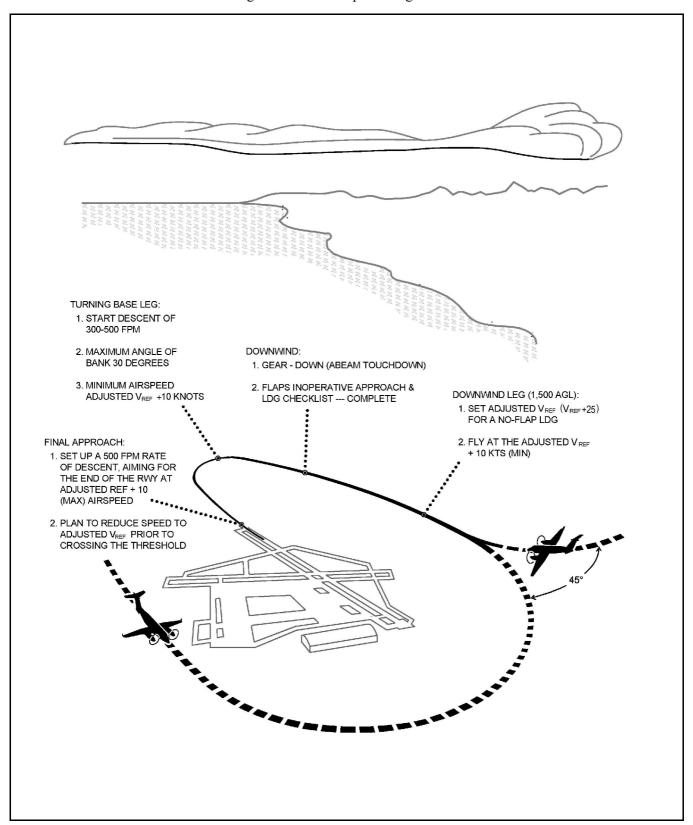


Figure 14-5. No Flap Landing Pattern



CHAPTER 15

Extreme Weather Operations

15.1 BLENDING ANTI-ICING ADDITIVE TO FUEL

The following procedures must be observed when blending anti-icing additive with the fuel:

- 1. The additive must conform to specification MIL-I-27686 or MIL-I-85470.
- 2. The concentration of the additive must be a minimum of 0.10% and a maximum of 0.15% by volume. Thus, a 20 oz. (591.5 ml) can of additive is sufficient for 105 to 155 gallons (398 to 586 liters) of fuel.
- 3. When blending the additive as the airplane is being refueled, use the following precautions:
 - a. Refuel at a rate of 30 to 45 gallons (114 to 170 liters) per minute. A rate of less than 30 GPM (114 LPM) may be used when topping off the tanks.
 - b. Start additive flow after fuel flow starts, and stop before fuel flow stops.
 - c. Ensure additive is directed into the flowing fuel stream.
 - d. Do not allow concentrated additive to contact coated interior of fuel cells or airplane surfaces.

15.2 COLD WEATHER PROCEDURES (SNOW, SLUSH AND ICE)

15.2.1 Preflight Inspection

Verify that the tires are not frozen to the ramp, and that the brakes are free of ice contamination. Deicing or anti-icing solutions may be used on the tires and brakes if they are frozen. Solutions which contain a lubricant, such as oil, must not be used as they will decrease the effectiveness of the brakes.

In addition to the normal exterior preflight inspection, special attention should be given to all vents, openings, static ports, control surfaces, hinge points, the stall warning vane, and the wing, tail, and fuselage surfaces for accumulations of ice or snow. Removal of these accumulations is necessary prior to takeoff. Airfoil contours may be altered by the ice and snow to the extent that their lift qualities will be seriously impaired. Ice and snow on the fuselage can increase drag and weight. Frost that may form on the wing fuel tank bottom skins need not be removed prior to flight. Frost that may accumulate on other portions of the wing, the tail surfaces, or on any control surface, must be removed prior to flight.

Inspect the propeller blades and hubs for ice and snow. Unless engine inlet covers have been installed during snow or icing conditions, the propellers should be turned by hand in the direction of normal rotation to ensure they are free to rotate prior to starting engines.

The removal of frozen deposits by chipping or scraping is not recommended. A soft brush, squeegee, or mop may be used to clear snow that is not adhering to the surfaces. If use of deicing/anti-icing fluids are required to produce a clean airplane, special attention must be given to ensure that the pitot masts, static ports, fuel vents, stall warning vane, cockpit windows and the area forward of the cockpit windows are free of the deicing/anti-icing solution. Both wings and both stabilizers must receive the same complete treatment. The type and concentration of deicing/anti-icing solution being applied and the rate of precipitation will affect the length of time the treatment will be effective. See Chapter 4, Operating Limitations, for a list of approved fluids.

If airplane is cold soaked to a temperature between -35 °C and -10 °C, the cockpit liquid crystal displays may experience a short delay after battery power is applied. Preheating of the cabin to 0 °C or above will shorten this delay.

Complete the normal preflight procedures, including a check of the flight controls for complete freedom of movement.

After engine start, exercise the propellers through low- and high-pitch and into reverse range to flush any congealed oil through the system.

Turn the brake deicing system on prior to taxi, if the brakes require deicing.

15.2.1.1 Taxiing

Taxiing through deep snow or slush should be avoided when possible. Snow and slush can be forced into brake assemblies which may cause the brakes to freeze during a prolonged hold on the ground or during the subsequent flight. Keep flaps retracted during taxiing to avoid throwing snow or slush into flap mechanisms and to minimize damage to flap surfaces.

Glaze ice can be difficult to see. Therefore, taxi slowly and allow more clearance from objects when maneuvering the airplane.

15.2.1.2 Before Takeoff

After completion of the normal Before Takeoff checklist, verify that the airplane is still free of frozen contaminants.

Ensure the runway is free from hazards such as snow drifts, glazed ice, and ruts.



Ice, frost, or snow on top of deicing/anti-icing solutions must be considered as adhering to the airplane. Takeoff should not be attempted.

If the OAT is +5 °C or below and visible moisture will be encountered during the takeoff, engine anti-ice must be turned on.

15.2.1.3 Takeoff

Allow additional take-off distance when snow or slush is on the runway. Extra cycling of the landing gear when above 500 feet AGL may help clear any contamination from the gear system.

When using FAA Approved SAE Type II, Type III or Type IV deicing/anti-icing fluids in the concentrated form, the control column force required to rotate for takeoff may temporarily increase approximately 20 pounds. The cruise, descent, approach and landing phases of flight are not affected by the use of these fluids.

15.2.1.4 Landing

If it is possible that the brakes may be restricted by ice accumulations from previous ground or in-flight icing conditions, turn the brake deicing system (if installed) on during the descent.

Braking and steering are less effective on slick runways. Also, hydroplaning may occur under wet runway conditions at higher speeds. Use the rudder to maintain directional control until the tires make solid contact with the runway surface.

Selecting ground fine or reverse thrust can effectively reduce stopping distances on slick runways; however, reverse thrust may cause snow or moisture to be thrown forward, temporarily reducing visibility.

15.2.1.5 Shutdown and Securing

Avoid setting the parking brake, if possible. This will help reduce the possibility of freezing the brakes. Proper chocking can be used to prevent the airplane from rolling.

15.2.2 Icing Flight

This airplane is approved for flight in icing conditions as defined in 14 CFR Part 25, Appendix C. These conditions do not include, nor were tests conducted in, all icing conditions that may be encountered (e.g., freezing rain, freezing drizzle, mixed conditions, or conditions defined as severe). Some icing conditions not defined in 14 CFR Part 25 have the potential of producing hazardous ice accumulations, which will result in the following:

- 1. Exceed the capabilities of the airplane's ice protection equipment.
- 2. And/or, create unacceptable airplane performance.

Flight into icing conditions which lie outside the 14 CFR-defined conditions is not prohibited; however, pilot's must be prepared to divert the flight promptly if hazardous ice accumulations occur.

Refer to Chapter 4, Operating Limitations for limitations relating to icing flight, Chapter 13, Abnormal Procedures for procedures associated with icing equipment malfunctions and procedures required for severe icing conditions, and A1-C12WA-NFM-200, Performance Data Supplement for performance degradations associated with icing flight.

15.2.3 Icing Conditions



Due to distortion of the wing airfoil, an accumulation of one inch of ice on the leading edges can cause a loss in rate of climb of 500 FPM, a cruise speed reduction of up to 75 knots TAS, as well as a significant buffet and stall speed increase (up to 15 knots IAS). Even after cycling the deicing boots, the ice accumulation remaining on the boots and unprotected areas of the airplane can cause large performance losses. For the same reason, the aural stall warning system may not be accurate and should not be relied upon. However, with ice accumulations on the airplane, significant aerodynamic buffet will occur in advance of the stall. Maintain a comfortable margin of airspeed above the normal stall airspeed. In order to minimize ice accumulation on unprotected surfaces of the wing, maintain a minimum of 140 knots during operations in sustained icing conditions. In the event of windshield icing, reduce airspeed to 226 knots or below. Prior to a landing approach, cycle the deicing boots to shed any accumulated ice.

- 1. Engine ice protection.
 - a. When visible moisture is encountered at +5 °C and below.
 - b. Or, at night when freedom from visible moisture is not assured at +5 °C and below (Operation of strobe lights will sometimes show ice crystals not normally visible).
 - (1) Engine Anti-ice ON, [L ENG ANTI-ICE] & [R ENG ANTI-ICE] ILLUMINATED.
 - (2) Check for proper operation by noting torque drop.



If in doubt, actuate the Engine Anti-ice System. Engine icing can occur even though no surface icing is present. If freedom from visible moisture can not be assured, engine ice protection should be activated. Visible moisture is moisture in any form; clouds, ice crystals, snow, rain, sleet, hail or any combination of these.

Note

Illumination of the [L ENG ICE FAIL] or [R ENG ICE FAIL] caution annunciator indicates failure of selected system on affected engine. Immediate illumination indicates loss of power to the actuator. Select the other actuator(s).

2. Engine auto-ignition — ARM.

Note

Engine Auto-Ignition must be ARMED for icing flight, precipitation, and operation during turbulence. To prevent prolonged operation of the ignitors with the system ARMED, do not reduce power levers below 17% torque.

- 3. Prop deice AUTO.
 - a. The system may be operated continuously in flight, and will function automatically until the switch is turned off.
 - b. Relieve propeller imbalance due to ice by increasing rpm briefly and returning to the desired setting. Repeat as necessary.



If the deice ammeter does not indicate 26 to 32 amperes, or the automatic timer fails to switch, refer to Chapter 13, Abnormal Procedures.

4. Surface deice.



All components of the surface deice system must be monitored during icing flight to ensure the system is functioning normally.

- a. Monitor the following components of the surface deice system, during icing flight, to ensure the system is functioning normally:
 - (1) Pneumatic Pressure Gage The gage should indicate 12.0 20.0 psi before boots are activated. The pressure will momentarily decrease when the boots are activated.
 - (2) Vacuum Gage The gage should indicate in the area of the green arc corresponding to the airplane altitude. The vacuum will momentarily decrease when the boots are activated.
 - (3) [WING DEICE] & [TAIL DEICE] annunciators The [WING DEICE] annunciator will illuminate within 6 seconds and the [TAIL DEICE] annunciator will illuminate within 10 seconds of switch activation when using the SINGLE mode. All annunciators will illuminate within 6 seconds of switch activation when using the MANUAL mode.
 - (4) Pneumatic Boots Visually monitor the boots, where possible, to ensure ice is being removed.



Operation of the surface deice system in ambient temperatures below -40 $^{\circ}$ C can cause permanent damage to the deice boots.

Note

- If either surface deice annunciator fails to illuminate or extinguish during a boot cycle, refer to Surface Deice Failure in Chapter 13, Abnormal Procedures.
- Either engine will supply sufficient air pressure for deice operation. In the event of failure of SINGLE cycle, use MANUAL cycle.
- b. When ice accumulates to 1/2 to 1 inch:
 - (1) Surface Deice Switch SINGLE AND RELEASE, [WING DEICE] & [TAIL DEICE] ILLUMINATED, THEN EXTINGUISHED.
 - (2) Repeat as required.
- c. If single position of the surface deice switch fails:
 - (1) Surface Deice Switch MANUAL AND HOLD, [WING DEICE] & [TAIL DEICE] ILLUMINATED (within 6 seconds), THEN RELEASE.
 - (2) Repeat as required.
- 5. Windshield anti-ice NORMAL/HIGH.

Note

Maximum airspeed for effective windshield anti-icing is 226 knots.

- 6. Left and right fuel vent heat ON.
- 7. Left and right pitot heat ON.
- 8. Stall warn heat ON.
- 9. Wing ice lights AS REQUIRED.
- 10. Alternate static source See Chapter 13, Abnormal Procedures.

15.3 DEICING AND ANTI-ICING OF AIRPLANES ON THE GROUND

Deicing is the removal of ice, frost, and snow from the airplane's exterior after it has formed. Anti-icing is a means of keeping the surface clear of subsequent accumulations of ice, snow and frost.

Snow and ice on an airplane will seriously affect its performance. Removal of these accumulations is necessary prior to takeoff. Airfoil contours may be altered by the ice and snow to the extent that their lift qualities will be seriously impaired. Ice and snow on the fuselage can increase drag and weight.

15.3.1 Snow Removal

The removal of frozen deposits by chipping or scraping is not recommended. The best way to remove snow is to brush it off with a squeegee, soft brush, or mop. Exercise care so as not to damage any components that may be attached to the outside of the airplane, such as antennas, vents, stall warning vanes, etc. Remove loose snow from the airplane before heating the airplane interior; otherwise, at low temperatures, the snow may melt and refreeze to build up a considerable depth of ice. If the airplane has been hangared and snow is falling, coat the airplane surfaces with an anti-icing solution; snow falling on the warm surface will have a tendency to melt, then refreeze.

After snow has been removed from the airplane, inspect the airplane for evidence of residual snow, special attention should be given all vents, openings, static ports, control surfaces, hinge points, and the wing, tail, and fuselage surfaces for obstructions or accumulations of snow. Check the exterior of the airplane for damage to external components that may have occurred during the snow removal operations.

Control surfaces should be moved to ascertain that they have full and free movement. The landing gear mechanism, doors, wheel wells, uplocks and microswitches should be checked for ice deposits that may impair function.

When the airplane is hangared to melt snow, any melted snow may freeze again if the airplane is subsequently moved into subzero temperatures. Any measures taken to remove frozen deposits while the airplane is on the ground must also prevent the possibility of refreezing of the liquid.

Following snow removal, should freezing precipitation continue, the airplane surface should be treated for anti-icing.

15.3.2 Frost Removal

Frost that may form on the wing fuel tank bottom skins need not be removed prior to flight. Frost that may accumulate on other portions of the wing, the tail surfaces, or on any control surface, must be removed prior to flight. Frost that cannot be removed by wiping with a gloved hand or soft towel must be removed by placing the airplane in a warm hangar or by the application of a deicing fluid.

After removal of all frost from the airplane exterior, check all external components for damage that may have occurred during frost removal.

15.3.3 Ice Removal

Moderate or heavy ice and residual snow deposits should be removed with a deicing fluid. No attempt should be made to remove ice deposits or break an ice bond by force.

After completing the deicing process, the airplane should be inspected to ensure that its condition is satisfactory for flight. All external surfaces should be examined for residual ice or snow, special attention should be given all vents, openings, static ports, control surfaces, hinge points, and the wing, tail, and fuselage surfaces for obstructions or accumulations of ice or snow.

Control surfaces should be moved to ascertain that they have full and free movement. The landing gear mechanism, doors, wheel wells, uplocks and microswitches should be checked for ice deposits that may impair function.

When the airplane is hangared to melt ice, any melted ice may freeze again if the airplane is subsequently moved into subzero temperatures. Any measures taken to remove frozen deposits while the airplane is on the ground must also prevent the possible refreezing of the liquid.

Following ice removal, should freezing precipitation continue, the airplane surface should be treated for anti-icing.

15.3.4 Deicing and Anti-Icing Fluid Application

Airplane deicing fluids may be used diluted or undiluted according to manufacturer's recommendations for deicing. For anti-icing purposes, the fluids should always be used undiluted. Deicing fluids may be applied either heated or unheated. Refer to Chapter 4, Operating Limitations, for a listing of approved airplane deicing/anti-icing fluids.

Note

Type II and Type IV deicing fluids should only be applied at low pressure by trained personnel with proper equipment.

If a sprayer is not available, deicing fluid may be brushed or painted onto the airplane's surfaces.

15.4 TURBULENT WEATHER

A complete and current weather briefing is a requirement for a safe trip. Updating of weather information enroute is also essential. Plan the flight to avoid areas of reported turbulence.

Regard thunderstorms, squall lines, and violent turbulence as extremely dangerous, and avoid when possible. Thunderstorms also pose the possibility of a lightning strike. A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence. The absence of a roll cloud, however, should not be interpreted as turbulence free.

It is not always possible to detect individual storm areas or find the in-between clear areas. If turbulence is unexpectedly encountered, note the following.

Proper airspeed answers two basic problems when flying through turbulent air.

If the crew maintains excessive airspeed, structural damage or failure may occur. If airspeed is too low, a stall may occur. Reduce speed to the turbulent air penetration speed or to maneuvering speed in Chapter 4, Operating Limitations. These speeds present the best assurance of avoiding excessive stress loads and providing the proper margin against inadvertent stalls due to gusts.

Beware of over controlling in an attempt to correct for changes in attitude. Applying control pressure abruptly builds up G-forces rapidly. This could cause structural damage or even failure. Watch angle of bank. Make turns as wide or as shallow as possible.

Be equally cautious in applying forward or back pressure to keep the aircraft level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly out of trim as the vertical air columns change velocity and direction. Lower the landing gear, if necessary, to avoid excessive airspeeds.

15.4.1 Windshear

Windshears are rapid, localized changes in wind direction. They can occur vertically or horizontally. Windshear is very dangerous, particularly on approach to landing when airspeeds are slow.

A horizontal wind shear is a sudden change in wind direction or speed that can transform a headwind into a tailwind. This produces a sudden decrease in airspeed because of the inertia of the aircraft. A vertical wind shear is a sudden updraft or downdraft. Microbursts are intense, highly localized severe downdrafts.

The prediction of windshear is far from an exact science. Monitor airspeed carefully when flying in storms, particularly on approach. Be mentally prepared to add power and go around at the first indication of encountering windshear.

15.5 WEATHER RADAR SYSTEM

The Weather Radar System is a fully integrated system that detects precipitation, moisture-based turbulence and ground feature returns in front of the airplane, which can be displayed on the PFDs or MFD and features the following operating modes (Figure 15-1).

15.6 WX-1000E STORMSCOPE

The WX-1000E Stormscope is a thunderstorm mapping system that provides distance and bearing of lightning strikes on the pilot's MFD when selected for display. An external "Storm Scope Clear" annunciator switch is provided on the instrument panel to clear the display of "clutter" or old lightning information. The stormscope system has no dedicated control.

A Stormscope system has no cockpit controls other than a white "Storm Scope Clear" momentary annunciator switch (Figure 15-2), located in the reversionary panel, to clear the display of "clutter" or old lightning information.

Refer to Pro Line 21 Operator's Guide for more detailed information.

15.7 WEATHER RADAR

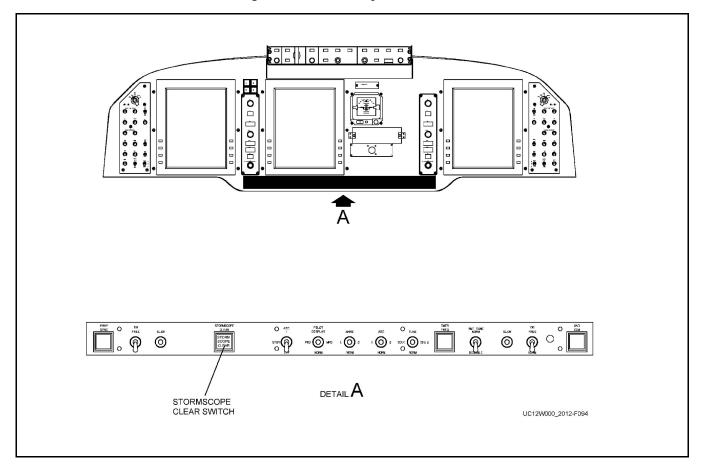
Airborne weather avoidance radar is, as its name implies, for avoiding severe weather, not for penetrating it. Whether to fly into an area of radar echoes depends on echo intensity, spacing between the echoes, and the capabilities of you and your airplane. Remember that weather radar detects precipitation drops. Except for the most advanced radar units, it does not detect turbulence. Therefore, the radar scope provides no assurance of avoiding turbulence. The radar scope also does not provide assurance of avoiding instrument weather from clouds and fog. Your scope may be clear between intense echoes; this clear area does not necessarily mean you can fly between the storms and maintain visual sighting of them.

Thunderstorms build and dissipate rapidly. Therefore, do not attempt to plan a course between echoes. The best use of ground radar information is to isolate general areas and coverage of echoes. You must avoid individual storms by in-flight observations either by visual sighting or airborne radar. It is better to avoid the whole thunderstorm area than to detour around individual storms, unless they are scattered.

Figure 15-1. Weather Radar System — Operating Modes

MODE	DESCRIPTION
WX (Weather) Mode	The basic weather detection mode. Depicts areas of precipitation with four different colors, determined by reflectivity strength.
MAP Mode	Used to depict the display colors on the PFD/MFD as accentuated ground features.
WX+T (Weather Plus Turbulence) Mode	Contains WX mode features and includes detection of precipitation-related turbulence targets, including wind shifts that contain precipitation.
TURB (Turbulence) Mode	Shows areas of precipitation-related turbulence within 50 nautical miles.
TARGET (Target/Turbulence Alert) Mode	Used as an alert for precipitation and/or precipitation-related turbulence.

Figure 15-2. Stormscope Clear Switch



Remember that while hail always gives a radar echo, it may fall several miles from the nearest visible cloud and hazardous turbulence may extend to as much as 20 miles from the echo edge. Avoid intense or extreme level echoes by at least 20 miles; that is, such echoes should be separated by at least 40 miles before you fly between them. With weaker echos you can reduce the distance by which you avoid them.

Above all, remember this; never regard any thunderstorm lightly. Even when radar observers report the echoes are of light intensity, avoiding thunderstorms is the best policy. The following are some do's and don'ts of thunderstorm avoidance:

- 1. Don't land or take off in the face of an approaching thunderstorm. Sudden gust-front low level turbulence could cause loss of control.
- 2. Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.
- 3. Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.
- 4. Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.
- 5. Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.
- 6. Do circumnavigate the entire area if the area has 6/10 or more thunderstorm coverage.
- 7. Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.
- 8. Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

If you cannot avoid penetrating a thunderstorm, the following are some do's BEFORE entering the storm:

- 9. Tighten your safety belt, put on your shoulder harness, and secure all loose objects.
- 10. Plan and hold your course to take you through the storm in minimum time.
- 11. To avoid the most critical icing, establish a penetration altitude below the freezing level or an altitude where the OAT is -15 °C or colder.
- 12. Verify that pitot heat is on, and activate anti-ice systems. Icing can be rapid at any altitude and can cause almost instantaneous power failure and/or loss of airspeed indication.

15.8 MOUNTAIN FLYING

Pilots flying in mountainous areas should inform themselves of all aspects of mountain flying, including the effects of topographic features on weather conditions.

Avoid flight at low altitudes over mountainous terrain, particularly near the lee slopes. If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with extreme up and down drafts and severe turbulence. The worst turbulence will be encountered in and below the rotor zone, which is usually 8 to 10 miles downwind from the ridge. This zone is sometimes characterized by the presence of "roll clouds" if sufficient moisture is present. Altocumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent upon moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as assurance that mountain wave turbulence will not be encountered. A mountain wave downdraft may exceed the climb capability of your airplane. Avoid mountain wave downdrafts.

15.9 HOT-WEATHER OPERATIONS

During hot-weather operations, the principal difficulties encountered are high ITT during engine starting, overheating of brakes, and longer takeoff and landing rolls because of the less dense hot air. In areas where high humidity is encountered, nonmetallic materials will be subject to moisture absorption. In very dry areas, additional precautions must be taken to protect the aircraft from damage caused by dust or sand. Particular care should be taken to prevent the entrance of dust or sand into the various aircraft components and systems (engine, fuel system, pitot static system, etc.).

15.9.1 Before Starting Engines

- 1. Make visual inspection of the aircraft exterior, checking for system leaks, sand or dust accumulation, and tire over-inflation.
- 2. Consider starting engines into the wind to minimize peak ITT.

15.9.2 Taxiing and Takeoff

- 1. Avoid excessive use of brakes.
- 2. When OAT is greater than 10 °C, verify generator loadmeters are 30% or less with A/C ON and 50% or less with A/C OFF.
- 3. Monitor ITT and torque limits.
- 4. Be prepared for slower acceleration, longer takeoff distance, and reduced thrust at all power settings because of lower density air in hot weather.

15.9.3 Before Leaving Aircraft

- 1. Install wheel chocks and release wheel brakes.
- 2. Check that all protective covers are installed.

15.10 DESERT OPERATIONS

Sand, dust, and high temperatures encountered during desert operations can sharply reduce the operational life of the aircraft and its equipment. The abrasive qualities of dust and sand could cause destructive effects upon turbine blades and moving parts. In flight, dust and sand will be difficult to escape, since dust clouds over a desert may be found at altitudes up to 10,000 feet.

15.11 VFR AT NIGHT

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers, or communities in the area. This is especially true in mountainous terrain, where there is usually very little ground reference. Minimum clearance is 2,000 feet above the highest obstacle en route. Do not depend on your ability to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be the same as IFR.

PART VII

Communications

Chapter 16 — General

Chapter 17 — Communications

Chapter 18 — Navigation

Chapter 19 — Transponder/IFF

CHAPTER 16

General

16.1 COMMUNICATION SYSTEM

The communication systems consists of a High Frequency (HF) radio, two Very High Frequency (VHF) radios, a combination Very High Frequency (VHF)/Ultra High Frequency (UHF) radio, two audio control panels, and two Control Display Units (CDU). The HF and VHF radios can be tuned by the CDU whereas the VHF/UHF has its own control head.

16.2 NAVIGATION SYSTEM

The navigation systems provide the pilot and copilot with various sources of aircraft relative position. Information can be entered and displayed for precise navigation to or from a destination. The main component of the navigation system is the Electronic Flight Instrument System (EFIS) that is used to display an integrated presentation utilizing inputs from various sources. The navigation systems also include the Dual FMS-3000 Flight Management System (FMS), Tactical Air Navigation (TACAN), Air Data System (ADS), Attitude Heading Reference System (AHRS), Radio Altimeter (RA), Global Positioning System (GPS), Automatic Direction Finder (ADF), VHF Navigation Receivers, and Distance Measuring Equipment (DME) for navigation.

Airborne safety systems include the Traffic Collision Avoidance Systems (TCAS), Terrain Awareness Warning System Plus (TAWS+), and an Electronic Standby Indicator System (ESIS).

The WX-1000E Stormscope system has no cockpit controls other than a white "Stormscope Clear" momentary annunciator switch, located in the Reversionary Panel (Figure 2-7), to clear the display "clutter" or old lightning information. The system includes a processor, antenna, and reversionary panel annunciator switch. The system is controlled by the EFIS.

The IFF transponder system is made up of a transponder, two antennas, a crypto applique, and a control panel.

16.3 RADAR SYSTEM

The Weather Radar (WX) system consists of a single Receiver/Transmitter Antenna (RTA) assembly, which is controlled by the EFIS.

16.4 ANTENNAS

The antennas associated with these systems are illustrated in Figure 16-1.

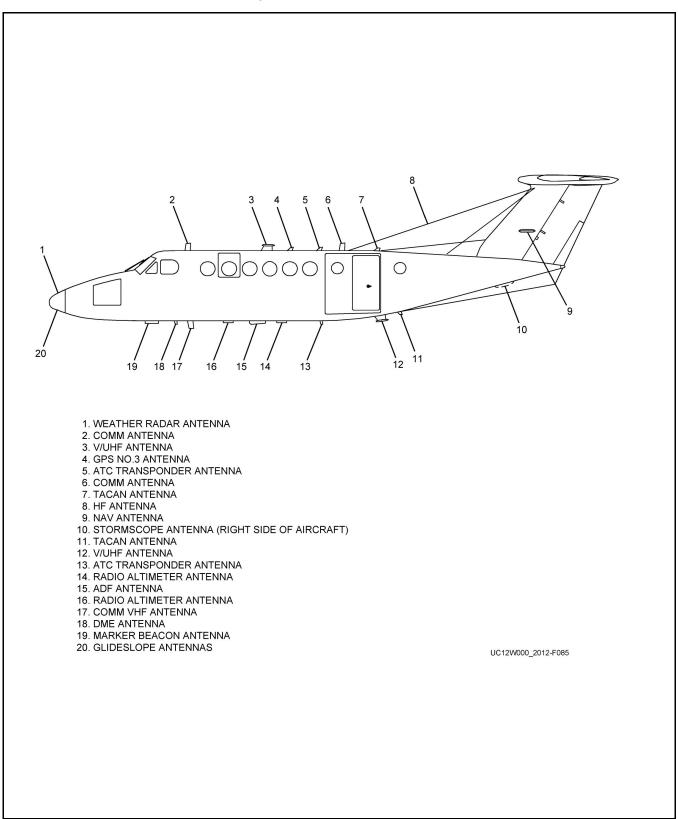
16.5 RADIO TUNING SYSTEM

The Radio Tuning System provides the control, displays, and sensors for VHF voice communication, HF voice communication, VOR/ILS/DME, ADF, transponder tuning, and TCAS II. The system consists of a radio tuning unit contained in each CDU which are located in the pedestal. The tuning capabilities of the CDUs are accessed using the TUNE page.

A CDU TUNE reversionary switch is located on the reversionary panel. With this switch in the NORM position, radios may be tuned using either CDU.

If radio tuning capability is lost from the CDUs, the EMER TUNE switch, located on the reversionary panel, may be pushed to tune the No. 1 Com to the emergency frequency of 121.5 MHz. Activation of the switch is denoted by the illumination of the annunciator, 121.5, located on the switch.

Figure 16-1. Antenna Locations



The radio tuning unit in each CDU has the capability of automatically tuning the VHF NAV receivers in order to improve the calculation of aircraft position by the FMS. This auto tune function is selected on the NAV CONTROL page of the CDU. The auto tune function is automatically cancelled if any of the following occur: DME HOLD is selected; a NAV receiver is manually tuned using either CDU; the FMS is deselected as a NAV source; or a NAV receiver fails.

If a malfunction occurs in the auto tune function, it may be manually disabled using the RMT TUNE switch which is located on the reversionary panel. Moving this switch from the NORMAL position to the DISABLE position will disable the auto tuning function of the CDU.

Each CDU is protected by a 3-amp circuit breaker, placarded CDU NO. 1 and CDU NO. 2.

For further information, refer to the Collins Pro Line 21 Avionics and Flight Management System Pilot's Guides.

CHAPTER 17

Communications

17.1 AUDIO SYSTEM

The audio system consists of dual DB-700 audio amplifiers, a crew interphone system, cabin PA, and pilot and copilot audio control panels. The audio control panels are located on the instrument panel adjacent to each PFD and have similar functions as described in Figure 17-1.

17.2 HF COMMUNICATIONS

17.2.1 Description

The Collins HF-9000 High-Frequency Communications System provides a worldwide communications capability. The system consists of an HF-9031A Receiver-Transmitter and a HF-9041 Antenna Coupler, both located in the aft avionics compartment. An HF wire antenna is located on the top of the fuselage and extends back to the vertical stabilizer. All functions of the HF radio can be controlled through CDU1 or CDU2. The HF radio is powered from the Left Generator Avionics Bus. Two circuit breakers are located on the Right Circuit Breaker Panel (Figure 2-22), one labeled HF COM (25-amperes) to protect the receiver-transmitter, and one labeled HF ANT (5-amperes) to protect the antenna coupler. Power is applied to the HF radio when the Avionics Master switch is turned on.

The HF radio operates in the HF band of 2.0000 to 29.9999 MHz in 100-Hz steps. Operating Emission modes include upper sideband voice (UV), lower sideband voice (LV) and amplitude modulation equivalent (AM). Both Simplex and Half-Duplex Tuning Modes are available.

Note

The AM Emission Mode has a frequency band width of 15 KHz. Thus, radio stations with frequencies separated by 15 KHz or less may be received simultaneously.

Four HF Tuning Modes and one Test Mode are available; a Frequency Tuning Mode, an Emergency Tuning Mode, a Maritime (ITU) Tuning Mode, a Preset Tuning Mode, and a Test Mode. Refer to Figure 17-2.

17.2.2 Operation

Three levels of transmission power are available; LO (approximately 15 Watts average), MED (approximately 30 Watts average), and HI (approximately 50 Watts average).

Because HF radio transmissions can interfere with ADF signal reception, the ADF receiver freezes the existing bearing indication whenever the HF transmitter is keyed.

The CDU contains three pages that can be used for control of the HF radio; page 2 of the Tune page, the HF1 Control Page and the HF1 Presets page. Refer to Figure 17-3.

Figure 17-1. Pilot/Copilot Audio Control Panel 4 **XMIT** . VHF2 y/UHF 101 TOSO 4 MIC NOTE: -VHF OXY PILOT AUDIO CONTROL PANEL SHOWN, COPILOT AUDIO CONTROL PANEL NORM SIMILAR. V/UHF PΑ AUTO COMM **TACAN** SPKR AUDIO 🕀 INPH VOICE B IDENT H 4 4 1. TRANSMIT (XMIT) SELECT/VOLUME SWITCH 2. TRANSCEIVER AND RECEIVER AUDIO CONTROL KNOBS 3. MIC SWITCH 4. PA (PUBLIC ADDRESS) AUDIO CONTROL 5. AUDIO COMM SWITCH 6. SPEAKER (SPKR) SWITCH 7. INTERPHONE (INPH) AUDIO CONTROL KNOB 8. ALTERNATE AUDIO SWITCH 9. VOICE - BOTH - INDENT SWITCH UC12W000_2012-F086 **INDEX ITEM FUNCTION**

1

Transmit (xmit) Select

switch

The XMIT select switch is used for selecting the Comm transceiver to be used for transmissions and includes VHF, V/UHF, and PA (for the cabin

public address). The switch also incorporates a master VOL control knob.

Figure 17-1. Pilot/Copilot Audio Control Panel (cont.)

INDEX	ITEM	FUNCTION	
2	Transceiver and Receiver Audio Controls	Each Comm transceiver and Nav receiver has an audio control incorporating a pull-on/ push-off switch and a rotary volume control. The audio controls are used to enable the audio of incoming radio receptions and include HF, VHF1, VHF2, V/UHF, NAV 1, NAV 2, DME, TACAN, ADF, and MKR (for marker beacon). When the audio control is pulled out, the audio for the selected transceiver or receiver can be heard over the headphones and speaker, if selected on. (When the audio control is pushed in, its volume level remains fixed at the last setting.) Rotating the audio control after it has been pulled out increases or decreases the volume. The audio controls include a white band that becomes visible when the control is pulled on to indicate the active position.	
3	Mic Switch	In the NORM position, the hand mic and boom mic are active. In the OXY position, the mic in the oxygen mask is active and the cockpit speakers are automatically selected on.	
4	PA (Public Address) Audio Control	This control functions in a manner nearly identical to the Comm and Nav audio controls. The only difference is that the control does not incorporate a pull-on/push off feature, but instead is always on. When transmissions are made using the PA function of the XMIT select switch, rotating this control increases or decreases the volume of the audio from the cabin speakers.	
5	Auto Comm Switch	The Auto Comm switch works in conjunction with the XMIT switch and the Audio Controls of the radio transceivers. If the Auto Comm switch is selected, the Audio Control associated with the radio selected with the XMIT switch does not have to be on (pulled out) in order to hear incoming audio. If the Auto Comm switch is not selected, the Audio Control associated with the radio selected with the XMIT switch must be pulled out in order to hear incoming audio.	
		Note	
		The volume controls adjust the audio volume from both the speakers and the headsets. It is not possible to adjust the volume of the speakers independently of the volume of the headset.	
6	Speaker (Spkr) Switch	When the SPKR switch is selected, the pilot and copilot overhead speakers are enabled. The audio volume from the speakers is controlled by the master VOL knob located on the XMIT switch and the Audio Controls.	
		Note	
		The same control on the copilot's audio panel does not incorporate the pull-on/push-off switch. Only the pilot's control can turn the system on or off.	
7	Interphone (Inph) Audio Control	This control functions in a manner similar to the Comm and Nav audio controls. Pulling the control out enables the cockpit interphone system. Pushing the control in disables the system. Rotating the control increases and decreases the volume of the interphone system.	
		Note	
		Transmissions may be made on V/UHF and the PA, but V/UHF receptions are not possible.	

Figure 17-1. Pilot/Copilot Audio Control Panel (cont.)

INDEX	ITEM	FUNCTION	
8	Alternate Audio Switch	The Alternate Audio switch is normally left in the NORM position. If the audio amplifier fails, the audio panel will not function normally and the Alternate Audio switch must be placed to the ALTN position. When the ALTN mode is selected, the pilot can transmit and receive on VHF using a boom mic, cockpit speaker or headphones. The volume of radio receptions is not controllable.	
9	Voice — Both — Ident Switch	This switch controls the input filtering of the NAV 1, NAV 2, and ADF controls. In the VOICE position, Morse codes are filtered out and only voice transmissions are heard. In the BOTH position, both voice and Morse code transmissions will be heard. In the IDENT position, only Morse code transmissions will be heard.	

Figure 17-2. HF Tuning and Test Modes

MODE	DESCRIPTION
Frequency Tuning Mode	Allows any valid frequency (either Simplex or Half-Duplex) and its emission mode to be manually set in the Active frequency window or the Active frequency window of the CDU.
Emergency Tuning Mode	Consists of 6 emergency channels (stored in non-volatile memory) which may be set into the Active frequency window of the CDU.
Maritime (ITU) Tuning Mode	Consists of 249 ITU (International Telecommunications Union) public correspondence channels that are stored in non-volatile memory. These channels may also be set into the Active frequency window of the CDU.
Preset Tuning Mode	Consists of twenty user-defined channels. The CDU can be filled with Simplex and Half-Duplex frequencies and their emission modes as well as Emergency channels and Maritime channels.
TEST mode	Allows for testing the system on the ground or in the air. The test may be conducted from the CDU. No HF setting can be changed during the test.

Figure 17-3. HF Features

	TOP LEVEL DISPLAY, NEXT PAGE	HF1 MAIN DISPLAY PAGE (HF1 CONTROL)	HF1 PRESETS PAGE (HF1 PRESETS)
FUNCTION	CDU	CDU	CDU
Tune Active Freq	X	X	X
Tune Recall Freq			
Change Squelch	Х	Х	
Change Emission Mode (UV, LV, AM)	Х	Х	Х
Change Transmission Power (LO, MED, HI)		X	
Access HF1 Preset Page		X	
Conduct SELF TEST		X	
Select Simplex or Duplex	X	X	X

Figure 17-3. HF Features (cont.)

	TOP LEVEL DISPLAY, NEXT PAGE	HF1 MAIN DISPLAY PAGE (HF1 CONTROL)	HF1 PRESETS PAGE (HF1 PRESETS)
FUNCTION	CDU	CDU	CDU
Change Tuning Mode (FREQ, PRESET, EMER, MAR)			
Program Presets Freqs			X

17.2.3 CDU Procedures

The following procedures are a basic guide to operating the HF radio using the CDU. A shorthand is used to denote key positions. For example: the third Line Select Key on the Right side of the display will appear as LSK R3.

- 1. Press the Tune Function Key to select the Tune page.
- 2. Select page 2 of the Tune page by pressing the NEXT key.
- 3. The active HF frequency is shown in the HF sub-display opposite LSK L4 along with the associated Emission mode.
- 4. The Squelch setting is shown between LSKs L5 and L6. These LSKs may be used to adjust the squelch from 0 to 3.
- 5. The HF frequency may be tuned by entering it in the scratch pad and then pressing LSK L4. The following procedures are used to enter the desired frequency channel:
 - a. Enter the frequency in MHz in the scratch pad using up to 6 digits, followed by the desired Emission mode (e.g., 10.2345AM). The decimal point is optional if no decimal digits are required; however, if a decimal point is not used, add the letter F after the digit to distinguish it from an emergency channel.
 - Example: 5F may be entered for the frequency 5.0000. (If the FREQ Tuning Mode of the radio has been selected, the F is not required.)
 - b. If only the Emission mode of the existing frequency needs to be changed, enter only the desired mode in the scratch pad (e.g., UV, LV, or AM).
 - c. If a Half-Duplex operating mode is required, enter either the Transmitting or Receiving frequency, preceded by the letter T or R. Enter a space using the SP key, then enter the second frequency preceded by T or R. The Emission mode follows the last frequency with no space.
 - Example: T10.1234(space)R15.1234UV.
 - d. When entering an Emergency or Maritime (ITU) channel, the letter E or M must follow the channel unless the Tuning Mode of the preset frequency matches the existing Tuning Mode of the radio.
 - For example, the following channels would be entered as shown: 6E = Emergency channel 6 and 408M = Maritime channel 0408.
- 6. Press LSK L4 to select the HF1 Control page.
 - a. The active HF frequency and Emission mode is displayed adjacent to LSK L1 and may be changed as described in Step 5.
 - b. The Squelch setting is shown between LSKs L3 and L4. These LSKs may be used to adjust the squelch from 0 to 3.
 - c. The Tuning Mode may be changed using LSK L5. Each push of the LSK cycles the Tuning mode between FREQ, EMER, and MAR.
 - d. The HF1 Presets page is selected using LSK L6.

- e. The transmission power of the HF radio is set using LSK R1. Each push of the LSK cycles the power between LO, MED, and HI.
- f. Press LSK R2 to activate the self-test.
 - (1) The white TEST legend changes to cyan and enlarges.
 - (2) After approximately 14 seconds, the cyan TEST legend is replaced by a green PASS message. This message will remain unless the frequency, power level, or Tuning Mode is changed. However, it is not necessary to clear the PASS message in order to run another self-test or use the radio.
- 7. Press LSK L6 to select the HF Presets page.
 - a. The active frequency can be changed using LSK L1 as previously described in Step 5.
 - b. Twenty preset frequencies and/or channels can be set on five preset pages. Pages are selected using the NEXT or PREV keys.
 - c. A preset frequency may be entered as a Simplex frequency, Half-Duplex frequency, Emergency channel, or Maritime channel as described in Step 5.
 - d. An identifier can be associated with a preset frequency or channel. The identifier can be up to 12 characters long and must begin with a letter, but may contain digits. If sufficient space is available in the scratch pad, the identifier may be included as the last portion of the frequency entry, with a space separating the two. If sufficient space is not available, the identifier may be added as a separate entry after the frequency has been entered.
 - e. To load a preset frequency into the active window, use either the left or right LSK associated with the desired frequency. The frequency will be loaded into the CDU.

17.3 VHF COMMUNICATIONS

17.3.1 Description

The VHF Communication System provides 2-way VHF voice communication. The system consist of dual audio amplifiers, which can be tuned by CDU1 or CDU2, and has a frequency range of 118.000 to 136.975 MHz. Volume control for the system is provided by the audio control panel. Power to operate the VHF 1 transceiver is provided by the Triple-Fed Avionics Bus through a 7.5-ampere circuit breaker, labeled COM 1. Power to operate the VHF 2 transceiver is provided by the Right Generator Avionics Bus through a 7.5-ampere circuit breaker, labeled COM 2.

17.4 AN/ARC-210 VHF/UHF RADIO

17.4.1 Description

The ARC-210 receiver-transmitter is capable of providing air-to-air, air-to-ground, and ground-to-air communication. The system provides two-way communication links for voice in the VHF frequency band 108.000 to 173.975 MHz and in the UHF frequency band of 225.000 to 399.975 MHz (EX+ Functions allow 400 – 511.99 MHz). Channel spacing of 8.33 kHz is available in the VHF band from 118.0 to 136.975 MHz. The device is controlled via the integrated control panel (Figure 17-4), which is located on the left side of the pedestal. The ARC-210 receiver-transmitter has secure voice capability. Power to operate the ARC-210 system is provided through the Mission Power switch to the V/UHF Com 3 Bus. Power is then distributed to a 7.5-ampere circuit breaker, labeled RT, a 30-ampere circuit breaker, labeled AMP, a 5-ampere circuit breaker, labeled CONT, and a 3-ampere circuit breaker, labeled ANT CVTR. All the ARC-210 system circuit breakers are located on the Auxiliary Circuit Breaker Panel (Figure 2-23).

1 4 5 6 2 3 24 4-EMER-4 4 OD SND TOD RCV GPS RT SELECT 23 OFF 8 SOL 7 Н AM/FM MENU F 22 TIME XMT/RCV OFFSET 9 H SEND RCV 21 10 19 NTER 11 20 ADF MAN CHG PRST MAR PRST TR+G 17 # ECCM^S MASTER ^121 (PULL) OFF 12 (PULL) CHANNEL 18 16 15 13 13. FREQUENCY MODE SWITCH 1. DISPLAY AREA 2. TOD SEND BUTTON 14. FREQUENCY SELECTOR SWITCH 3. TOD REC BUTTON 15. CHANNEL SWITCH 16. FREQUENCY SELECTOR SWITCH 4. GPS BUTTON 5. RT SELECT BUTTON 17. FREQUENCY SELECTOR SWITCH 6. SQL / ON / OFF KNOB 18. OPERATIONAL MODE SWITCH 7. AM / FM BUTTON 19. FREQUENCY SELECTOR SWITCH 8. MENU / TIME BUTTON 20. DOWN ARROW BUTTON 9. OFFSET RCV BUTTON 21. UP ARROW BUTTON 10. XMT / RCV / SEND BUTTON 22. BOTTOM ARROW BUTTON 11. ENTER BUTTON 23. MIDDLE ARROW BUTTON 12. FREQUENCY SELECTOR SWITCH 24. TOP ARROW BUTTON UC12W000_2012-F087 **INDEX** ITEM **FUNCTION** 1

Figure 17-4. AN/ARC-210 Control Panel

Figure 17-4. AN/ARC-210 Control Panel (cont.)

INDEX	ITEM	FUNCTION
2 & 3	EMER TOD	Pressing TOD SND and TOD RCV (receive) keys simultaneously for at least 1 second with 1) the radio set control set to any frequency; 2) the Operational Mode switch in the TR+G (transmit and receive plus guard), TR, or ADF (automatic direction finding) position; and, 3) the Frequency Mode switch in the ECCM MASTER (electronic counter-countermeasure), ECCM, MAN (manual), PRST (preset), or MAR (maritime) modes; commands receiver-transmitter to reset the HAVE QUICK master clock.
3	TOD RCV	TOD RCV key. When pressed, commands receiver-transmitter to receive TOD from another transmitter.
4	GPS	GPS (Global Positioning System) key. When pressed, commands receiver-transmitter to load the TOD from a GPS receiver.
5	RT SELECT	Inoperative.
6	SQL ON/OFF	SQL (squelch) OFF/ON rotary switch. Receiver-transmitter squelch circuits are disabled in the OFF position and enabled in the ON position.
7	AM/FM	AM/FM (amplitude/frequency modulation) key. When pressed, receiver-transmitter modulation is toggled between AM and FM. Selected mode is shown on display screen.
8	MENU/TIME	MENU/TIME key. Provides for the selection of menu screens used to perform various auxiliary functions or the display of current time. In SINCGARS mode, the time is displayed. In HAVE QUICK mode, the options include HQ SETTINGS, COMSEC, and RADIO SETTINGS.
9	OFFSET/RCV	OFFSET/RCV key. Provides for the selection of offsets from 5 to 20 kHz from the selected frequency over the range of 30 to 399.975 MHz except for the very high frequency (VHF) ATC frequency range. In the ATC frequencies, provides for offsets of 8.33 to 16.66 kHz which result in an 8.33-kHz bandwidth mode for European ATC.
		Pressing the key increments the channel name displayed. The receiver-transmitter software interprets the channels from the radio set control to provide the appropriate frequency.
10	XMT/RCV/SEND	XMT (transmit) /RCV/SEND key. When pressed, toggles between the XMT/RCV and SND functions. XMT/RCV provides for the exchange of location of transmit and receive frequency display when programming preset satellite communication (SATCOM) or half-duplex channels. When RECV is shown in the center of the display, receive frequency can be modified. When XMIT is shown in the center of the display, transmit frequency can be modified.
		The SEND function commands the receiver-transmitter to send single channel ground and airborne radio set (SINCGARS) lockout or hopset numbers.
11	ENTER	ENTER key. When pressed, commands the radio set control to transmit its configuration information to the selected receiver transmitter. Once the ENTER key has been activated for a given receiver-transmitter, it is no longer necessary to use the ENTER key to send serial data to the selected receiver-transmitter. ENTER key activation is required only when switching between control of RT1 and RT2 if ENTER key is enabled.
12, 14, 16, 17, 19	Frequency Selector Switches	Rotary switches are used to select the desired frequency for the receiver-transmitter. Only valid frequencies are allowed. Valid frequencies are 30 to 87.975 MHz, 108 to 173.975 MHz, and 225 to 399.975 MHz (EX+Functions allow 400 – 511.99 MHz).

Figure 17-4. AN/ARC-210 Control Panel (cont.)

INDEX	ITEM	FUNCTION
13	Frequency Mode	Isolated position rotary switch (knob must be pulled out to enter or exit positions marked PULL) selects one of the following seven frequency modes for the selected receiver-transmitter:
	ECCM MASTER	ECCM MASTER selects operation in the electronic protection (EP) frequency mode with the added functions associated with SINCGARS MASTER NET CONTROLLER.
	ECCM	ECCM selects operation in the EP frequency mode (HAVE QUICK, HAVE QUICK II, or SINCGARS).
	PRST	PRST selects operation in the preset frequency mode. When in this mode, channel select switch (item 15) can be used to select one of 41 available preset channels. Channels 1 through 25 offer simplex channels, channels 26 through 30 offer half-duplex operation or wide-band SATCOM operation, channels 31 through 40 (or 41 through 50) offer half-duplex demand assignment multiple access (DAMA) SATCOM operation, and channel 41 (or 31) provides a scan channel.
	MAN	MAN selects operation in the manual frequency mode. When in this mode, frequency selection switches (items 12, 14, 16, 17, 19) can be used to tune to any valid frequency.
	MAR	MAR selects operation in the maritime frequency mode. When in this mode, channel select switch (item 15) can be used to select one of 57 international maritime channels. Refer to table 6-4 for listing of the channels and frequencies. The top soft-key (item 24) selects either ship or shore station frequency when in this mode.
	243	243 selects operation in the 243 MHz guard precedence frequency mode. When in this mode, the main receiver is tuned to the 243.000 MHz guard frequency. All communications secure (COMSEC) functions are disabled while in this mode.
	121 (PULL)	121 (PULL) selects operation in the 121.5 MHz guard precedence frequency mode. When in this mode, the main receiver is tuned to the 121.500 MHz guard frequency. All COMSEC functions are disabled in this mode.
15	CHANNEL	CHANNEL rotary switch is used to select desired channel or action depending on selected frequency mode:
		Selects one of 41 preset channels and modes when in PRST or CHNG PRST frequency mode.
		Selects one of 27 preset channels when in ECCM MASTER or ECCM frequency mode.
		Selects one of 57 maritime channels when in MAR frequency mode.
		Selects the day for HAVE QUICK auxiliary information when in the ECCM MASTER or ECCM frequency mode.
		Selects the day when using SINCGARS in ECCM MASTER or ECCM frequency mode.
		Selects HOPSETS and LOCKSETS when using SINCGARS in ECCM MASTER or ECCM frequency mode.

Figure 17-4. AN/ARC-210 Control Panel (cont.)

INDEX	ITEM	FUNCTION
18	Operational Mode	Isolated position rotary switch (knob must be pulled out to enter or exit positions marked PULL) initiates one of the following seven operational modes for the receiver-transmitter:
	TR+G	TR+G selects receiver-transmitter operation in both transmit and receive modes for both the main receiver and the guard receiver. If the radio set control receives a hard-wire input on the guard precedence line, however, the radio set control commands the receiver-transmitter to tune to 243.000 MHz.
	TR	TR selects receiver-transmitter operation in both transmit and receive modes for the main receiver. The guard receiver is turned off.
	ADF	ADF selects receiver-transmitter operation in the ADF mode.
	CHG PRST	CHG PRST (change preset) selects receiver-transmitter operation which allows information for the currently selected preset channel to be defined and loaded into that channel location. Also puts receiver-transmitter into the TR mode of operation.
	TEST	TEST commands receiver-transmitter and radio set control to perform built-in test (BIT). Results of BIT for both radio set control and receiver-transmitter are shown in the display area (item 1). Moving the Operational Mode switch out of the TEST position terminates BIT.
		BIT does not function or ceases to function if the radio set control receives a guard precedence command (hard-wire input), the Frequency Mode switch is placed in the 243 position, or the Operational Mode switch is placed in the ZERO (PULL) position.
	ZERO (PULL)	ZERO (PULL) commands receiver-transmitter to zeroize EP parameters, COMSEC keys, and DAMA orderwire keys. Zeroizing of the receiver-transmitter is not completed until a ZEROIZE COMPLETE message is displayed.
20	↓	↓ key. When pressed, display brightness is decreased.
21	1	↑ key. When pressed, display brightness is increased.
22	→ (BOTTOM)	Bottom → key. Key function depends on menu displayed when key is pressed. Key is active only when the Operational Mode switch is in the TR+G, TR, or ADF mode position and the Frequency Mode switch is in the ECCM MASTER, ECCM, PRST, or MAN mode position.
		If not in a menu and the receiver-transmitter is in a cipher mode, this key cycles through encryption key numbers (can be in CHNG PRST mode).
23	→ (MIDDLE)	Middle → key. Key function depends on menu displayed when key is pressed. Key is active only when the Operational Mode switch is in the TR+G, TR, or ADF mode position and the Frequency Mode switch is in the ECCM MASTER, ECCM, PRST, or MAN mode position.
		If not in a menu, this key cycles through plain/cipher text operations (can be in CHNG PRST mode).

Figure 17-4. AN/ARC-210 Control Panel (cont.)

INDEX	ITEM	FUNCTION
24	\rightarrow (TOP)	Top → key. Key function depends on menu displayed when key is pressed. Key is active only when the Operational Mode switch is in the TR+G, TR, or ADF mode position and the Frequency Mode switch is in the PRST, or MAN mode position.
		If not in a menu, function of this key depends on frequency mode:
		In SINCGARS mode, performs LATE NET ENTRY (LE) function.
		In MAR mode, toggles between ship/shore frequencies.
		In MAN mode, returns receiver-transmitter to previous frequency.
		In CHNG PRST mode, loads new frequency/modulation pair.
		In ECCM MASTER or ECCM mode, loads new net number.

17.5 CONTROL DISPLAY UNIT

The pilot's CDU is used to control the Radio Sensor System (RSS) and provide integrated control of several combinations of airplane communications (including a normal means of radio tuning) and navigation radio subsystems.

The CDU also provides the following functions:

- 1. Control display from the Flight Management System (FMS).
- 2. Back-up display for Global Positioning System (GPS) data.
- 3. MFD menus.

The CDU is a color LCD display with an integrated keyboard. Five colors (cyan, yellow, magenta, white, and green) are used to show text. The display area supports 12 display lines of 24 characters plus a title line, scratchpad, and message line. The keyboard provides 16 function keys plus a full alphanumeric keypad. In addition, the CDU has six line select keys located in the bezel on each side of the display (Figure 17-5).

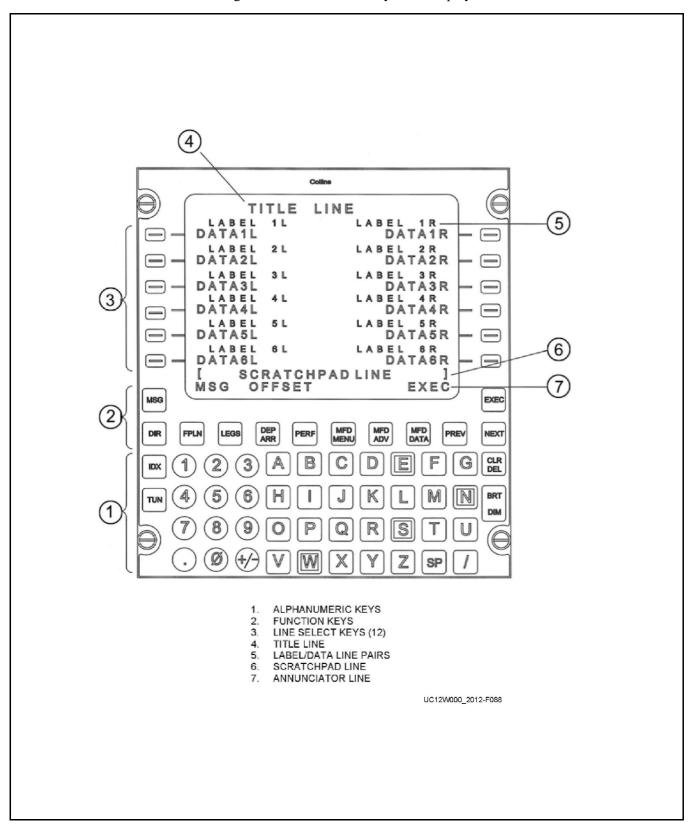
Text shows in either small or large size font. Prompts show on data lines as small square boxes. A prompt indicates data must be entered to perform the function related to the prompt's description on the label line. If no data is entered for a specific prompt, the FMS may not be able to perform the related function or will have degraded performance. Dashes show on data lines where data can be entered.

All operations for entering a flight plan, modifying an existing flight plan, or entering data for other FMS operating functions are done through the use of a scratchpad entry system. Entry for the scratchpad is by using the alphanumeric keyboard or by pushing a line select key to copy data shown on the display to the scratchpad. From the scratchpad, data is transferred by pushing the appropriate line select key to transfer the scratchpad content to the selected location.

The CDUs are located in the forward portion of the pedestal. Power to operate CDU1 is provided by the Left Generator Avionics Bus through a 3-ampere circuit breaker, labeled CDU1. Power to operate CDU2 is provided by the Right Generator Avionics Bus through a 3-ampere circuit breaker, labeled CDU2. Both circuit breakers are located on the right circuit breaker panel.

For complete information, refer to the Pro Line 21 Avionics System Operator's Guide.

Figure 17-5. FMS CDU Keys and Display



17.6 REVERSIONARY SWITCH PANEL

17.6.1 Description

The Reversionary Switch Panel (Figure 17-6), is located on the Instrument Panel and includes Tune Select and Emergency Frequency switches.

17.7 3RD CREW AUDIO

17.7.1 Description

3

GND COM ON

The system consists of an audio control panel (Figure 17-7), an ON/OFF volume control along with VOX control for interphone communications with the cockpit crew and monitoring of the pilot audio selections, receive and transmit. The 3rd crew audio system provides communication between the flightcrew and a 3rd crew member in the cabin. Power to operate the 3rd crew audio system is provided by the Right Generator Avionics Bus through a 2-ampere circuit breaker, labeled 3RD CREW AUDIO. The circuit breaker is located on the Right Circuit Breaker Panel (Figure 2-22).

EMER 0 0 RMT TUNE FRFQ ADC TUNE SI FW \mathcal{O} 0 CDU 1 \circ UC12W000 2012-F089 **ITEM DEFINITION INDEX** Tune Reversion Switch The TUNE reversion switch has three positions: NORM, CDU1, and CDU2. The NORM position will allow either CDU1 or CDU2 to control the RSS tuning. Should the CDU1 fail, placing the TUNE reversion switch in the CDU2 position will enable NAV1 or NAV2 tuning via the CDU2. Should the CDU2 fail, placing the TUNE reversion switch in the CDU1 position will enable NAV1 or NAV2 tuning via the CDU1. The EMER FREQ switch located on the reversion panel beneath 2 **Emergency Frequency** the MFD is used to tune the VHF COM radio to the emergency (121.5) Switch frequency of 121.5 MHz. All other tuning commands from the CDU

are ignored when this switch is pressed. The switch illuminates to

A push-on/push-off switch is used to activate or deactivate the

indicate that the emergency frequency is tuned.

ground communication system.

Figure 17-6. Reversionary Switch Panel

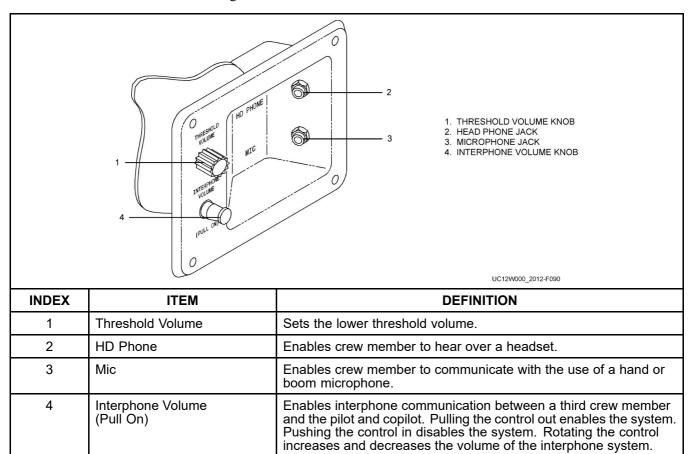


Figure 17-7. 3rd Crew Audio Control Panel

17.8 GROUND INTERPHONE SYSTEM

17.8.1 Description

The ground interphone system provides communication between personnel outside of the aircraft and the flightcrew. Audio is provided through the use of headphones, with speaker audio selectable. Control of the system consists of a push on/push off solenoid-held annunciator switch located on the Reversionary Switch Panel (Figure 17-6). The ground interphone system is automatically deactivated when the avionics master switch is turned on. Power to operate the ground interphone system is provided by the Battery Bus through a 5-ampere circuit breaker, labeled GND COM. The circuit breaker located on the fuel control circuit breaker panel.

17.9 COCKPIT VOICE RECORDER (CVR)

The CVR system consists of a cockpit voice recorder, a control unit, an area microphone, and an impact switch. Electrical power to the recorder is provided by the triple-fed bus. The recorder and impact switch are located in the aft avionics bay behind the pressure bulkhead. The control unit is located in the cockpit pedestal. The area microphone is located in the leading edge of the glareshield to the right of the fire extinguisher switch.

Input to the CVR recorder comes from the following four sources:

- 1. Cabin Pager (What the pilot or copilot transmit over the cabin pager).
- 2. Copilots Audio (What the copilot hears or transmits over the boom mic, hand mic, or oxygen mask mic).
- 3. Pilots Audio (What the pilot hears or transmits over the boom mic, hand mic, or oxygen mask mic).
- 4. Area mic.

The CVR will reproduce the last 120 minutes of audio recorded by the above channels in a high quality format on four separate channels.

The control unit contains the test switch, erase switch, indicating meter, and headset jack. the test switch and indicating meter provide a test of the recorder. The headset jack provides a means of monitoring all audio data that is being input to the CVR recorder to ensure that the recorder is receiving the proper audio signals. Pressing the test switch should result in the following indications if the recorder is functioning properly:

A delayed one- to two-second tone will be heard in the headset (if plugged into the control unit) when the test switch is pressed and held. The tone will then stop and the needle will move into the green arc on the meter and stay there as long as the switch is pressed.

The erase switch may be used to erase the entire recording after a routine flight, and will work when the landing gear is down and the weight of the airplane is on the landing gear. To prevent accidental erasures, a time delay circuit makes it necessary to hold the erase switch down for two seconds to start the erasure process. If a headset is plugged into the control unit, a proper erasure is indicated by a tone in the headset that occurs when the erase switch is released. The tone will last for approximately 5 seconds.

17.10 FLIGHT DATA RECORDER

17.10.1 Description

The FA2300 Flight Data Recorder (FDR) system consists of a flight data recorder and impact switch, located in the aft fuselage avionics bay. The FDR system is powered on anytime the airplane power is on. Power to operate the FDR system is provided by the Triple-Fed Bus through a 3-ampere circuit breaker, labeled CVDR. The circuit breaker located on the right circuit breaker panel.

The recorder will continuously record and retain the last 25 hours of flight data. The following parameters are recorded: Elapsed Time, Heading, Pilot Microphone Key, Copilot Microphone key, A/P Engage, Vertical Acceleration, Longitudinal Acceleration, Left and Right Engine Torque, Pitch Control Position, Control Wheel Position, Left and Right Engine Prop Reverse, Left and Right Prop rpm, Flap Position (Down, Approach, Up), Pitch and Roll Attitude, Altitude, and Airspeed. There are no controls associated with the recorder and its operation is completely automatic.

The FDR impact switch is located in the aft fuselage avionics bay and it will shut off the FDR on impact.

17.10.2 Test Procedure

- 1. Battery Switch ON.
- 2. TEST button Press and hold for a minimum of five seconds.
- 3. Green test light Illuminated.
- 4. ERASE button Press and hold for 2 seconds minimum (if desired).

Prior to first flight of the day:

- 5. Headphone Plug headphones into CVR control unit.
- 6. Speak 6 inches away from area microphone. Voice will play back in headphones with no delay or distortion.

17.11 MODULAR AIRBORNE DATA RECORDING ACQUISITION SYSTEM (MADRAS)

17.11.1 Description

The MADRAS is capable of both Cockpit Voice Recording and Digital Flight Data Recording, however for this installation it provides only for the Flight Data Recording (FDR) and receives power from the triple-fed bus. A circuit breaker is installed for the protection of the system, and a caution light on the Caution/Alert/Status panel provides for failure annunciation. Sensors are installed in multiple areas throughout the aircraft for data collection.

There are no controls or switches in the cockpit and its operation is completely automatic upon power-up. The system continuously records and retains flight data presented to it. The recorder will operate automatically until power is removed. should the amber CVDR/FDR FAIL light come on steady after initial power-up, the recorder may not be functioning properly.

The installation includes an impact switch, cable displacement position sensors for monitoring control surface and control input positions, and electrical interface to other aircraft systems for monitoring of other parameters.

The MADRAS contains internal self-test circuitry. After applying power to the flight recorder, the CVDR/FDR FAIL light in the CAS panel should illuminate momentarily (brief flash) then extinguish and remain out. The system will continue to execute a self-test for 60 seconds; if the light illuminates again during this time, the internal self-test circuitry has found a possible defect within the recorder.

17.12 EMERGENCY LOCATOR TRANSMITTER (ELT) WITH REMOTE SWITCH

The Artex C406-2 Emergency Locator Transmitter (ELT) System, is designed to meet the requirements of TSO C91a and C126. The system consists of the ELT transmitter and an alert horn located in the aft fuselage area, an antenna mounted on the aft fuselage, and a remote switch with a yellow transmit light located on the left cockpit sidewall next to the OAT gage. The purpose of the alert horn is to notify personnel that the ELT has been activated. The remote switch is lever-locked in the ARM and the ON positions. Neither this switch nor the switch on the ELT transmitter can be positioned to prevent the automatic activation of the ELT transmitter. The system is independent from other airplane systems except for the transmit light, which is hot-wired to the airplane battery, and the edge lit panel, which is controlled by the side panel light's rheostat located on the overhead panel. The Artex C406-2 ELT System also includes a latitude/longitude interface to the ELT itself so that the integrated system is capable of transmitting aircraft latitude and longitude information to the Cospas/Sarsat satellite system in the event of an aircraft mishap. An ELT/Navigation Interface Unit is located next the existing ELT in the aft pressure bulkhead.

Upon activation, the ELT will sound the alert horn and transmit a sweeping tone on 121.5 and 243.0 MHz. An additional frequency of 406.025 MHz is also transmitted, which is used by orbiting satellites to assist in determining airplane location. This activation is independent of the remote switch setting or availability of airplane power. the remote switch is installed to perform the following functions:

- 1. Test the ELT.
- 2. Deactivate the ELT if it has been inadvertently activated by the "G" switch.
- 3. Activate the ELT in an in-flight emergency if an off-airport landing is anticipated.
- 4. Activate the ELT after an off-airport landing, if the impact did not automatically activate it.

The ELT should be tested once a month using the following procedures. Testing in excess of once a month is not recommended, as it will shorten battery life.

- 1. Tests should be conducted between the times of on-the-hour until 5 minutes after the hour.
- 2. Notify any nearby control towers.

Note

Do not allow the test duration to exceed 15 seconds. The satellite system recognizes 406.025 MHz transmissions in excess of 15 seconds to be a valid distress signal.

- 3. Provide power to an airplane radio and tune it to 121.5 MHz.
- 4. Place the ELT remote switch ON. Wait for at least 3 sweeping tones on the airplane radio, which will take about 1 second, the return the switch to ARM.
- 5. The test is successful if the sweeping tones are heard and the transmit light next to the switch illuminates immediately. If there is a delay in the illumination of the transmit light, the system is not working properly.

The sounding of the alert horn does not predicate a successful ELT test nor is failure of the alert horn to sound an indication of ELT failure.

6. When the ELT remote switch is returned to the ARM position, the transmit light will stay illuminated for approximately 1 second and then extinguish. If the microprocessor in the ELT detects a problem, the transmit light will blink a specific number of times following the 1 second illumination to indicate the following faults:

Listed in order of priority with the highest priority being 1 blink:

- 1 Blink Indicates a G-switch loop open failure.
- 3 Blinks Indicates a 406.025 MHz transmitter problem.
- 5 Blinks Indicates there is no navigation data present. Since the UC-12W does not provide navigation data to the ELT, this coded signal will always be present.
- 7 Blinks Indicates a battery problem.

The Artex C406-2 will indicate all faults in order from highest priority to lowest priority.

If the ELT should be inadvertently activated by the "G" switch, the alert horn will sound and the transmit light next to the switch will blink. The ELT can be deactivated by momentarily placing the remote switch ON and then back to ARM.

For test procedures on the 406.025 MHz frequency, refer to the Artex Installation and Operational Manual.

17.13 IFIS-5000 INTEGRATED FLIGHT INFORMATION SYSTEM

17.13.1 Description

The Rockwell Collins IFIS-5000 Integrated Flight Information System (IFIS) supplements the EFIS-3000 Electronic Flight Instrument System portion of the Pro Line 21 system by providing advanced display functions to aid the pilot in charting and weather information. Features which may be used with the IFIS-5000 are as follows:

- 1. Electronic Charts Provides Jeppesen approach, departure, and airports charts. This function requires a subscription from Jeppesen.
- 2. Enhanced Map Overlays Provides additional overlays on the FMS planning map (PLAN) and present position map (PPOS). These overlays include Geographic features, Geo-Political boundaries, Airways, and Airspace.

The following line replaceable units comprise the IFIS-5000 System:

- 1. The FSU-5010 File Server Unit provides the processing and storage for all IFIS functions.
- 2. The AFD-3010E Adaptive Flight Display MFD (part of EFIS-3000) displays IFIS functions.
- 3. The CCP-3000 Cursor Control Panel located in the pedestal controls the IFIS functions via MFC on-screen menus. Dedicated controls are provided for chart selection, quick MFD format access keys and MFD menu controls. A joystick is used for panning across the charts.

More detailed information may be found in the Collins IFIS-5000 Integrated Flight Information System Operator's Guide, Document 523-0806347-005117, dated 4 April 2007, or later revision.

CHAPTER 18

Navigation

18.1 GENERAL

The navigation systems provide the pilot and copilot with various sources of aircraft relative position. Information can be entered and displayed for precise navigation to or from a destination. The main component of the navigation system is the Electronic Flight Instrument System (EFIS) that is used to display an integrated presentation utilizing inputs from various sources. The navigation systems also include the Dual FMS-3000 Flight Management System (FMS), Tactical Air Navigation (TACAN), Air Data System (ADS), Attitude Heading Reference System (AHRS), Radio Altimeter (RA), Global Positioning System (GPS), Automatic Direction Finder (ADF), VHF Navigation Receivers, and Distance Measuring Equipment (DME) for navigation.

18.2 ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

EFIS startup is automatic once power is applied to the aircraft and it consists of three 8" x 10" color composite Adaptive Flight Displays (AFD). The AFDs consist of two Primary Flight Displays (PFDs), a Multifunction Display (MFD), and two Display Control Panels (DCPs). The PFDs consist of a pilot side and copilot side system. Each side is functionally and physically isolated from each other and is capable of functioning as a complete, independent system.

The PFDs are located on the outer left and right edges of the instrument panel. The MFD is located in the center of the instrument panel.

The DCPs, in conjunction with the bezel-mounted switches on the PFD/MFD, provide the primary pilot interface to control the flight displays.

18.2.1 Primary Flight Display (PFD)

The PFD provides airplane attitude, heading, airspeed, altitude, vertical speed, flight guidance system annunciations and navigation data on a single integrated display. The PFD also provides engine display information when selected in reversionary mode. It also has the capability to display overlays from traffic, weather, and terrain. Refer to Rockwell Collins Pro Line 21 Operator's Guide.

18.2.2 Multifunction Display (MFD)

The MFD can be used to present a variety of information, including: Present Position Map, TCAS, and FMS based textual data, navigation data, weather radar and TAWS+. Engine data and the electronic checklist are also presented on the MFD. Refer to Rockwell Collins Pro Line 21 Operator's Guide.

18.2.3 Display Control Panel (DCP)

Two dedicated DCPs control the display and menu functions of the PFDs/MFD. The DCPs are located adjacent to the respective PFD/MFD they normally control. The DCP, when combined with the line select keys on the PFD, provides control of the weather radar, NAV sources, bearing pointers, V speeds, BARO minimums (Barometric Altitude-based Minimum Descent Altitude) and RA Minimums (Radio Altitude-based Decision Height Minimums). The DCPs are protected by 2-ampere circuit breakers, labeled PILOT DCP and COPILOT DCP, located on the Right Circuit Breaker Panel (Figure 2-22). They receive power from the Avionics Bus No. 1 and No. 2 respectively. Refer to Rockwell Collins Pro Line 21 Operator's Guide.

18.2.4 EFIS Reversionary Panel Switch

A PILOT DISPLAY switch on the reversionary panel allows custom control of composite PFD/MFD displays and emergency display back-ups for the pilot. Refer to Figure 2-7.

18.3 FLIGHT MANAGEMENT SYSTEM (FMS)

18.3.1 Dual FMS-3000 Flight Management Systems with 3rd Trimble GPS

The aircraft has been modified from the basic aircraft configuration of dual FMS and single Radio Tuning Unit (RTU) to a dual FMS only configuration. The RTU has been removed and all radio tuning functions have been transferred to the FMS CDU's. The FMS system software has been upgraded to version 3.3.1 to accommodate the 3rd (Trimble TA-24) GPS receiver and stand alone tuning of the APX-119 IFF transponder. All the functionality of the FMS remains unchanged from the basic system unless noted herein. A dedicated PPS-Y and PPS-MIXED code loading port for the TA-24 GPS is located in the cockpit pedestal along with GPS-3 ON/OFF and operational mode selection switches (Figure 18-1).

18.3.1.1 Dual FMS-3000 Flight Management Systems Navigational/Operational Capabilities

The Collins FMS-3000 provides centralized control for navigation, flight planning, radio tuning, and fuel management functions. For additional information, refer to the Beech King Air C90GTi/B200CGT/B300 FMS-3000 Flight Management System Operator's Guide, P/N 523-0790066, dated June 6, 2007 or later.

When FMS is the selected NAV source, Course Deviation Indicator (CDI) scaling (Figure 18-2) is as follows:

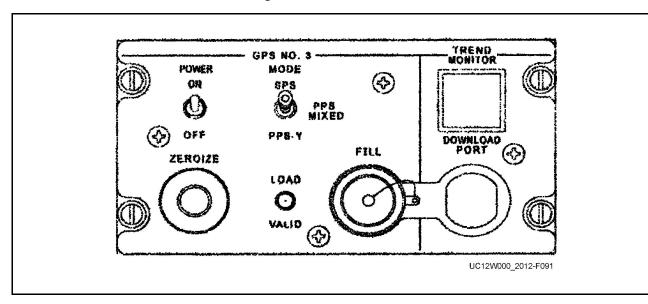


Figure 18-1. GPS No. 3 Control

Figure 18-2. Course Deviation Indicator (CDI) Scaling

FULL SCALE REPRESENTS:				
Installed GPS Sensor	Enroute	Terminal (Term Annunciated)	VOR/DME/RNAV Approach (APPR Annunciated)	GPS Approach (GPS APPR Annunciated)
Collins GPS-4000A	5 nm.	1 nm.	1 nm.	0.3 nm.

18.4 GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System (GPS) sensor provides accurate position information. The No. 1, No. 2, and No. 3 receivers are located in the Nose Avionics Bay, middle shelf. The power for the No. 1 GPS is from Left Generator Avionics Bus and a 3-amperes circuit breaker located on the right circuit breaker panel, labeled GPS1. The power for the No. 2 GPS is from Right Generator Avionics Bus and a 3-amperes circuit breaker located on the right circuit breaker panel, labeled GPS2. The No. 3 GPS system receives power through the Mission Power switch (Figure 2-20) to the Mission Bus and a 3-amperes circuit breaker located on the Auxiliary Circuit Breaker Panel (Figure 2-23), labeled No. 3 GPS. Refer to Rockwell Collins Pro Line 21 Operator's Guide.

18.5 AIR DATA SYSTEM (ADS)

Dual ADSs sense and process data obtained from the air mass around the airplane. The two Air Data Computers (ADC) connect to the pitot and static air input ports and to a temperature sensor. The ADCs process air data and provide output parameters to the PFD/MFD, AHCs and the IAPS concentrators.

Three switches located on the top left portion of the overhead panel, allow various altitude display and alert functions on the PDF. When the switch placarded BARO ALT FT - M is in the FT position, English units only will be displayed on the PDFs. When this switch is moved to the M position, Metric units will also be displayed in a box adjacent to its English equivalent on the PDFs. The second switch, placarded BARO IN -hPA, allows the pilot to toggle displayed units of pressure on the PDFs to English or Metric. The third switch, placarded FL180 ENABLE — DISABLE, will cause the altimeter setting to flash when enabled under the following conditions:

- 1. When entering FL180 from below 7,000 feet.
- 2. When descending through FL180 from above 18,500 feet.

For more information regarding the function and operation of these switches, refer to the latest version of the Collins Pro Line 21 Operator's Guide.

18.6 ATTITUDE HEADING REFERENCE SYSTEM (AHRS)

The Attitude Heading Reference System (AHRS) is a dual reference system that senses the aircraft attitude, heading, and three-axis rate/accelerations. The AHRS consists of two AHC-3000 Attitude Heading Computers (AHC), two FDU-3000 Flux Detector Units (FDU) and two External Compensation Units (ECU).

The AHRS supplies attitude, stabilized magnetic or free gyro heading and linear acceleration data to the Flight Guidance System, Electronic Flight Instrument System, Integrated Avionics Processor System and Weather Radar System.

The AHCs are functionally and physically isolated from each other and replace the conventional vertical gyro, directional gyro, three rate gyros, and three linear accelerometers. The AHRS has two operation modes, slaved and Directional Gyro (DG) mode.

18.7 RADIO ALTIMETER (RA)

The RA transceiver measures the aircraft radio altitude (up to 2,500 feet) above the terrain. This data is an analog output that is converted to a digital signal that is used by the autopilot (during approach) and FMS. The system is powered by the Right Generator Avionics Bus and is protected by a 2-amp circuit breaker located on the Right Circuit Breaker Panel (Figure 2-22) and labeled RADIO ALTM. The RADIO ALTM operates as a sensor system and the extracted information is displayed on the PFDs.

18.8 FLIGHT SYSTEM

18.8.1 Flight Guidance Panel (FGP)

The FGP is used to control the Flight Guidance System and is located in the center of the glareshield.

Command of the Flight Guidance System is accomplished by using the lateral and vertical mode select switches. VS/pitch wheel, autopilot switches, FD switches and various control knobs of the FGP along with the control wheel mounted synchronization (SYNC), autopilot disconnect (AP DISC) switches, and a left power lever mounted go-around (GA) switch.

Attitude reference, heading reference, airspeed reference, vertical speed reference and VS pitch reference are also controlled from the FGP.

18.8.2 Flight Guidance System (FGS)

The FGS provides autopilot and dual flight guidance functions by utilizing two identical computers, three primary servos, a pitch trim servo and flight guidance panel.

The Flight Guidance Computers (FGC) receive AHS data directly from the AHC to provide independent flight guidance computation while operating together to provide 3-axis autopilot, pitch trim and yaw damper functions.

The two FGSs apply differential autopilot command drive to each primary servo to move the airplane elevator, aileron and rudder control surfaces.

18.9 AN/ARN-153(V) TCN-500 TACAN SYSTEM

The TCN-500 TACAN system is an airborne TACAN System that operates in three basic modes (receive, transmit, and air to air transmit/receive) to provide distance, groundspeed, time-to-station, station identifier, and TACAN azimuth (bearing or radial) information. Navigation information is provided for display on both the pilot and copilot PFD/MFD displays via Nav Source Selection. TACAN audio selection is available on both pilot and copilot audio panels. A dedicated TACAN control is mounted in the cockpit pedestal.

The TACAN system operates in the L band of frequencies, providing 126 DME/TACAN channels, in which the designated X,Y pairs of ground to air and air to ground frequencies are separated by 63 MHZ. The receiver operates in the frequencies range of 962 to 1213 MHz, while the transmitter frequency ranges between 1025 MHz and 1150 MHz. The receiver frequency being either above or below the transmitter frequency, depending on whether it is an X or Y channel and on the channel number.

In transmit-receive mode, the AN/ARN-153(V) provides the following functions:

- 1. Continuous bearing to a TACAN ground station.
- 2. Aural identification of the ground beacon to which the system is channeled.
- 3. Distance (slant range) of the aircraft from the ground station.
- 4. Time-to-station (time for the aircraft to fly to the ground station).
- 5. Groundspeed (inbound or outbound aircraft speed in relation to the ground station).
- 6. Generation of a subselection output to external systems during the time of its own transmissions.

In the A/A transmit/receive mode, the TACAN operates as both interrogator and transponder and provides the following functions:

- 1. Responds to up to five aircraft when interrogated.
- 2. Provides slant range distance to the nearest complementary aircraft.
- 3. Provides time to the nearest complementary aircraft.
- 4. Shows speed at which aircraft is approaching or departing from nearest corresponding aircraft.
- 5. Generates a subselection output to external systems during the time of its own transmission.

The TACAN transceiver, located in the forward avionics compartment, is interfaced with both PFDs, top and bottom mounted antennas, and the audio control panels. The TACAN system receives power through the Mission Power

Switch (Figure 2-20) to the Mission Bus and a 5-ampere circuit breaker located on the auxiliary circuit breaker panel, labeled TACAN.

18.9.1 TACAN Control Panel

The TACAN Control Panel (Figure 18-3) is located in the right side of the extended pedestal console and provides the necessary controls to operate the system.

18.9.2 Normal Procedures

- 1. Mode Select switch SELECT.
- 2. TACAN Channel SELECT.
- 3. Volume Control Adjust as necessary.

Figure 18-3. TACAN Control Panel

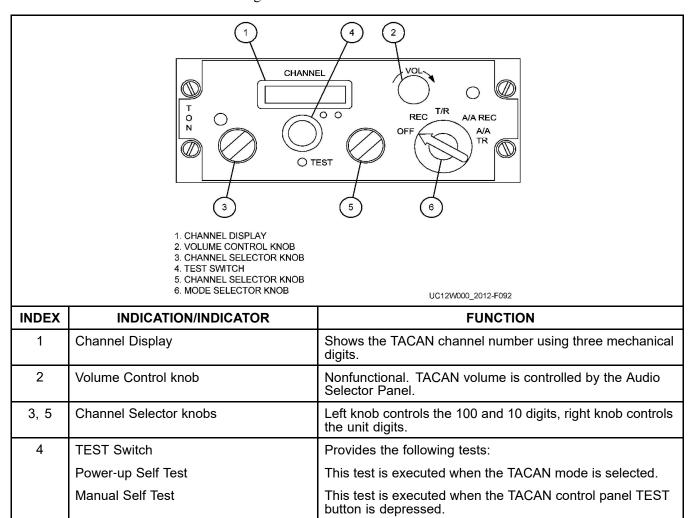


Figure 18-3. TACAN Control Panel (cont.)

INDEX	INDICATION/INDICATOR	FUNCTION
6	MODE SELECT SWITCH	Five-position rotary switch that enables the flightcrew to select between Off, Receive mode, Transmit/Receive Mode, Air-to-Air Receive mode, Air-to-Air Transmit/Receive mode,
	1. OFF	Removes power from the TACAN system.
	2. Receive (REC)	In this mode the system measures the magnetic bearing of a selected TACAN.
	3. Transmit/Receive (T/R)	In this mode the system measures the magnetic bearing, calculates relative bearing and slant range to the selected TACAN.
	4. Air-to-Air Receive (A/A REC)	In this mode the system receives bearing and slant range information from a suitably equipped aircraft if Automatic Gain Control is enabled and will not be available.
	5. Air-to-Air Transmit/Receive (A/A T/R)	In this mode the system operates as for REC mode except the bearing information relates to a suitably equipped aircraft.

The AN/ARN-153(V) TCN-500 TACAN operates using the dedicated control panel located in the pedestal for station tuning, received volume, test, and mode (T/R mode is normal mode). Selection for display of TACAN information is available on both the pilot and copilot PFDs as a navigation and bearing pointer source in the menu (TCN).

18.10 AIRSPEED SCALE

18.10.1 Overspeed Alerts

The V_{MO}/M_{MO} marker is a solid red bar that is constantly positioned from the top of the airspeed scale to the current value of V_{MO}/M_{MO} . The marker becomes emphasized and the airspeed digital readout changes color if the airspeed trend vector exceeds V_{MO}/M_{MO} (Overspeed Pre-alert) and/or the airspeed exceeds V_{MO}/M_{MO} (Overspeed Alert).

The overspeed pre-alert will occur when the airspeed trend vector exceeds V_{MO}/M_{MO} by 3 knots for 5 seconds or more. The overspeed pre-alert symbology consists of the following indications:

- The V_{MO}/M_{MO} marker will be emphasized by changing to a wide, red-outlined, red-and-black checkerboard pattern.
- 2. The airspeed digital readout will change color to yellow, flash for 5 seconds, then become steady.
- 3. If the MACH readout is displayed, the readout will change color to yellow, flash for 5 seconds, then become steady.
- 4. The overspeed pre-alert symbology will cease when the airspeed trend vector is less than or equal to V_{MO}/M_{MO} .

The overspeed alert will occur when the current airspeed exceeds V_{MO}/M_{MO} by 3 knots. The overspeed alert symbology and aural alert consists of the following indications:

- 1. The PFD's overspeed aural alert will sound.
- 2. The V_{MO}/M_{MO} marker will be emphasized by changing to a wide, red-outlined, red-and-black checkerboard pattern.

Note

Activation of the overspeed pre-alert will typically have already placed the checkerboard pattern into view.

- 3. The airspeed digital readout will change color to red, flash for 5 seconds, then become steady.
- 4. If the MACH readout is displayed, the readout will change color to red, flash for 5 seconds, then become steady.
- 5. The overspeed alert symbology and the aural alert will cease when the airspeed is less than or equal to V_{MO}/M_{MO} .

18.10.2 Low Speed Warnings

The Impending Stall Speed (ISS) Low Speed Cue (LSC) Marker is a solid red bar that is constantly positioned from the bottom of the airspeed scale to the current heavy weight stall speed as defined by the existing flap position. The ISS LSC is advisory in nature and is not a substitute for the stall warning system. The ISS LSC is not displayed until the weight-on-wheels switch is in the "air" position for at least 6 seconds. The following defines the ISS LSC value for each flap position:

Flap Position	ISS LSC (KIAS)
UP	96
APPROACH	89
DOWN	81

When a new flap position is selected, the ISS LSC value will change to the new ISS LSC value at the following rates:

- 1. When the flap lever is selected to an extend position (i.e., from UP to APPROACH, or from APPROACH to DOWN) the rate-of-change will be 1.5 knots per second.
- 2. When the flap lever is selected to a retract position (i.e., from DOWN to APPROACH, or from APPROACH to UP) the rate-of-change will be 3.5 knots per second.

The ISS LSC pre-warning occurs when the airspeed trend vector extends below the current ISS LSC value for at least 5 seconds. The ISS LSC pre-warning symbology consists of the following indications:

- 1. The ISS LSC marker will be emphasized by changing to a wide, red-outlined, red-and-black checkerboard pattern.
- 2. The airspeed digital readout will change color to yellow, flash for 5 seconds, then become steady.
- 3. If the MACH readout is displayed, the readout will change color to yellow, flash for 5 seconds, then become steady.
- 4. The ISS LSC pre-warning symbology will cease when the airspeed trend vector is greater than or equal to the ISS LSC value.

The ISS LSC warning will occur when the current airspeed becomes less than ISS LSC value. The ISS LSC warning symbology consists of the following indications:

1. The ISS LSC marker will be emphasized by changing to a wide, red-outlined, red-and-black checkerboard pattern.

Note

Activation of the pre-warning will typically have already placed the checkerboard pattern into view.

- 2. The airspeed digital readout will change color to red, flash for 5 seconds, then become steady.
- 3. If the MACH readout is displayed, the readout will change color to red, flash for 5 seconds, then become steady.

4. If the MACH readout is displayed, the readout will change color to red, flash for 5 seconds, then become steady.

If the flap lever input becomes invalid, a default ISS LSC is displayed. This display consists of the checkerboard bar with a yellow bar on top. The junction of the checkerboard bar with the yellow bar represents the flaps-down ISS LSC value, while the top of the yellow bar represents the flaps-up ISS LSC value. The ISS LSC warning function will continue to work as previously described, except the default ISS LSC marker will already be in view.

18.11 TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS II)

18.11.1 Description

The Collins TCAS-4000 is a TCAS II system and is designed to protect a volume of airspace around the airplane by warning the pilot of the threat of other transponder equipped airplanes penetrating that airspace. The system interrogates Mode C and Mode S transponders in nearby airplanes and analyzes their replies to identify potential and predicted collision threats. The system advises the pilot when to climb, descend, or maintain altitude to avoid passing too close to, or colliding with, the threat airplane. When an intruder airplane is equipped with TCAS II, the system coordinates avoidance maneuvers with this airplane using the data link capability of the Mode S transponders.

If traffic gets within 25 to 45 seconds (depending upon altitude) of the projected Closest Point of Approach (CPA), it is considered an intruder and a Traffic Advisory (TA) is issued. This TA calls attention to what may develop into a collision threat using visual and aural alerts. The visual alert consists of a solid yellow circle depicting the intruder on the traffic map and a yellow flashing TRAFFIC message on the PFDs. The aural alert consists of the voice message, TRAFFIC, TRAFFIC. These alerts promote mental and physical preparation for a possible maneuver that may follow, and assists the pilot in achieving visual acquisition of the intruding aircraft.

If the intruder gets within 20 to 35 seconds (depending upon altitude) of the CPA, it is considered a threat, and a Resolution Advisory (RA) is issued. This RA provides a recommended vertical maneuver using modified instantaneous vertical speed indicators (IVSIs) and voice messages to provide adequate vertical separation from the threat aircraft (a Corrective RA) or prevents initiation of a maneuver that would place the aircraft in jeopardy (a Preventive RA). In addition to the voice messages, e.g. CLIMB, CLIMB, the threat aircraft is depicted as a solid red square on the Traffic Map, and a red flashing TRAFFIC message is displayed on the PFDs. Refer to Rockwell Collins Pro Line 21 Operator's Guide.

The TCAS II system consists of a TCAS II receiver/transmitter, two TCAS directional antennas, and two diversity MODE S transponders with antennas. The system receives altitude and vertical speed information from the pilot's Air Data Computer (ADC1). If that system fails, information is provided by the copilot's Air Data Computer (ADC2). Radio altitude information is provided from the radio altimeter, and heading information from the pilot's AHRS. The system also receives inputs from the right weight-on-wheels switch and right landing gear downlock switch. The TCAS II system generates vertical guidance commands that are displayed on the pilot's and copilot's IVSIs in the form of vertical red and green bands. Vertical speeds located next to the red band are to be avoided. The vertical speed associated with the green band (either descending or climbing) is the vertical speed the pilot should attain. Intruder targets are displayed on the MFD on the TCAS Only Map, or may be overlaid on the Present Position Map. Aural alerts are sounded over the speakers, whether or not they are selected on, and also over the headsets. Controls for the TCAS II system are integrated into the CDU. The TCAS II is powered by the Left Generator Avionics Bus and is protected by a 5-amp TCAS circuit breaker located on the Right Circuit Breaker Panel. Power is applied to the system when the Avionics Master Switch is turned on. Refer to Rockwell Collins Pro Line 21 Operator's Guide.

18.11.1.1 Control

Controls are incorporated into both CDUs. Either unit may be used to control the system. The system is powered by the Left Generator Avionics Bus and is protected by a 5-amp TCAS circuit breaker located on the right circuit breaker panel. Power is applied to the system when the Avionics Master switch is turned on. Display overlays are controlled by PFD and MFD format selection. Refer to Figure 18-4 for TCAS II System Controls.

Figure 18-4. TCAS II System Controls

CONTROL	FUNCTION
TFC Line Select Key	 Turns Display ON or OFF. Selects Traffic Only Map (Hold for more than one second).
Range Knob, on Display Control Panel	Adjusts range of display from 5 nm to 50 nm.

18.11.1.2 MFD Displays

The following messages appear along the right side of the display when appropriate. They are listed as they would appear from top to bottom. Refer to Figure 18-5.

Figure 18-5. MFD Messages

MESSAGE	DESCRIPTION
ABS INOP (white)	If the Absolute Altitude Mode is selected and the airplane is below 18,000 feet PA, this display is presented.
ALT XXX (cyan)	If the Absolute Altitude Mode is selected and the airplane is above 18,000 feet PA, this display will show airplane pressure altitude in thousands and hundreds of feet. Example: 23,000 feet = 230.
ABOVE/BELOW (white)	These messages indicate the operating altitude volume of the TCAS system. These messages will be shown as ABOVE, ABOVE BELOW, BELOW, or will be blank. The operating volume of each display is as follows: ABOVE = -2,700 ft to +9,900 ft BELOW = +2,700 ft to -9,900 ft ABOVE/BELOW = -9,900 ft to +9,900 ft Blank = -2,700 ft to +2,700 ft
OFF (cyan)	This message indicates that the OTHER TRAFFIC symbol has been selected off.
TFC (white or cyan)	This legend indicates that the TCAS II system has been selected for display (cyan), or has been selected off (white).
TCAS TEST (cyan)	This message indicates that the TCAS II is in the Test Mode. (Color is white if TCAS display has not been selected).
TCAS OFF (cyan)	This message indicates that the Standby Mode of the TCAS system has been selected, the standby mode of the transponder has been selected, or that the Mode C has been selected OFF. (Color is white if the TCAS display has not been selected).
TA ONLY (cyan)	This message indicates that the TA Only Mode has been selected. It will always be displayed on the ground. The message will change color from cyan to yellow and flash when a TA is issued by the TCAS. (Color is white if TCAS display has not been selected).
TCAS FAIL (yellow)	This message indicates a TCAS fault has been detected.
TA or RA (with no bearing data)	Two lines are provided for the first two detected TAs or RAs without valid bearing data. Each line of data will be yellow for TA data or red for RA data. The format of each line will include the range of the intruder followed by the relative or absolute altitude, if available, and a rate-of-climb or descent direction arrow if applicable.

When the TCAS self-test is conducted as described in the Normal Procedures, the following test pattern will be displayed on the MFD:

- 1. Traffic Advisory (solid yellow circle) will appear at 9 o'clock, range 2 miles, 200 feet below, and climbing.
- 2. Proximate Traffic (solid cyan diamond) will appear at 1 o'clock, range 3.6 miles, 1,000 feet below, and descending.
- 3. Other Traffic (open cyan diamond) will appear at 11 o'clock, range 3.6 miles, 1,000 feet above, and in level flight.
- 4. Resolution Advisory Traffic (solid red square) will appear at 3 o'clock, range 2 miles, 200 feet above, and in level flight.

18.11.1.3 PFD Displays

The PFD does not display traffic unless in the reversionary mode. The following TCAS messages and displays are provided. Refer to Figure 18-6.

The following messages will be displayed, one at a time, just below the lower right corner of the EADIs:

MESSAGE	DESCRIPTION
TRAFFIC (yellow or red)	This message will be yellow for a TA and red for an RA. It will blink approximately 6 times and then become steady.
TCAS FAIL (yellow)	This message is identical to the one shown on the MFD.

Figure 18-6. PFD Messages

The following messages will be displayed on the right side of the PFD opposite the third Line Select Key. They are identical to those shown on the MFD:

- 1. TCAS TEST (white).
- 2. TCAS OFF (white).
- 3. TA ONLY (white).

During a Resolution Advisory, red or red and green bands will be displayed on the IVSI. There are two types of RA's; corrective and preventive.

If a corrective RA is issued, red and green bands will be displayed. The green band indicates the rate-of-climb or descent required for the pilot to obtain in response to the RA. The red bands indicate the rate-of-climb and descent the pilot is to avoid during the response to the RA.

If a preventive RA is issued, normally only a single red band will be displayed indicating the vertical speeds to be avoided. If intruders exist above and below the airplane, it is possible to have a green band covering the lower rates-of-climb and/or descent followed by two red bands indicating the higher rate-of-climb and descent to avoid.

During the TCAS self-test, the IVSI will display the following test pattern:

- 1. A red band will extend from 0 fpm to the bottom of the display.
- 2. A green band will extend from 0 fpm to +300 fpm.
- 3. A red band will extend from +2000 fpm to the top of the display.

18.11.1.4 System Characteristics

Only the TA Only Mode is available during ground operations. The RA Mode is available after takeoff above approximately 1,150 feet.

The Traffic Display may be overlaid on the radar or TAWS+ display on the MFD.

TAWS+ and radar displays are not available on the TCAS Traffic Only map.

TAWS+ voice alerts have priority over TCAS II voice messages. During such occasions, the TCAS II will automatically switch to the TA Only Mode with no TCAS voice messages.

The TCAS II surveillance may not function at distances less than 900 feet.

CLIMB and INCREASE CLIMB RAs are inhibited with flaps extended beyond the Approach position.

CLIMB and INCREASE CLIMB RAs are inhibited above 32,000 feet P.A.

When below approximately 1,000 feet, the TCAS II will automatically revert to the TA Only Mode.

All RA and TA voice messages are inhibited below 600 feet AGL while climbing and below 400 feet AGL while descending.

DESCEND RAs are inhibited below 1,200 feet AGL while climbing and below 1,000 feet AGL while descending. INCREASE DESCENT RAs are inhibited below 1,450 feet AGL.

18.11.1.5 Voice Messages (TA)

The following voice message accompanies a TCAS II Traffic Advisory (TA):

VOICE MESSAGE	PILOT RESPONSE
TRAFFIC, TRAFFIC	Gain visual contact with traffic. Check the TCAS II display for range and bearing of the traffic if necessary. Assess the threat and prepare to execute the evasive maneuver if a Resolution Advisory is subsequently issued.

18.11.1.6 Voice Messages (RA)

The following voice message accompany TCAS II Resolution Advisory Traffic (RA's):

VOICE MESSAGE	PILOT RESPONSE
CLIMB, CLIMB, CLIMB (corrective)	Change vertical speed to 1,500 fpm climbing, or as indicated by the green band on the IVSI.
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB (corrective)	Same as previous except that this message indicates that flight paths will cross at some altitude.
INCREASE CLIMB, INCREASE CLIMB (corrective)	This follows a CLIMB voice message. The climbing vertical speed is typically increased to 2,500 fpm as shown by the green band on the IVSI.
ADJUST VERTICAL SPEED, ADJUST (corrective)	Reduce climbing vertical speed to that shown on the IVSI.
DESCEND, DESCEND NOW (corrective)	This follows a CLIMB voice message. This message indicates that a reversal of vertical speed from a climb to a descent is needed to provide adequate separation.
DESCEND, DESCEND, DESCEND (corrective)	Change vertical speed to 1,500 fpm descending, or as indicated by the green band on the IVSI.
DESCEND, CROSSING DESCEND, DESCEND, CROSSING DESCEND (corrective)	Same as previous except that this message indicates that flight paths will cross at some altitude.

VOICE MESSAGE	PILOT RESPONSE	
INCREASE DESCENT, INCREASE DESCENT (corrective)	This follows a DESCENT voice message. The descending vertical speed is typically increased to 2,500 fpm as shown by the green band on the IVSI.	
ADJUST VERTICAL SPEED, ADJUST (corrective)	Reduce descending vertical speed to that shown on the IVSI.	
CLIMB, CLIMB NOW (corrective)	This follows a DESCEND voice message. This message indicates that a reversal of vertical speed from a descent to a climb is needed to provide adequate separation.	
CLEAR OF CONFLICT	Resume normal flight. Apparent conflict of airspace has been resolved.	
MONITOR VERTICAL SPEED (preventive)	Be alert for approaching traffic. Make sure that the IVSI needle does not enter the area of the red band.	
MAINTAIN VERTICAL SPEED, CROSSING, MAINTAIN (preventive)	A flight path crossing is predicated, but being monitored by the TCAS II. Maintain present vertical speed and direction. Make sure that the IVSI needle does not enter the area of the red band.	
ADJUST VERTICAL SPEED, ADJUST (preventive)	Indicates a weakening of the RA. This allows the pilot to start returning to an assigned altitude.	

18.11.2 Terrain Awareness and Warning System PLUS (TAWS+)

Refer to Operator's Guide Collins Pro Line 21 Avionics System with optional IFIS for Beechcraft King Air, P/N 523-0808535, dated June 1, 2007, or later version.

Refer to Aviation Communication and Surveillance Systems (ACSS) TAWS+ Pilot's Guide, Document No. 8006772-001, dated March 2007, or later revision.

The information in the ACSS Pilot's Guide is applicable except in the four areas noted below:

- 1. The radio altitude of 245 feet depicted in the "Too Low Flaps" envelope shown in Figure 1-16 (Too Low Terrain/Gear/Flaps envelope for Mode 4) on page 1-29 of the ACSS Pilot's Guide should read 195 feet.
- 2. The terrain display patterns shown in Figure 2-2 (Terrain Display Patterns for Various Terrain Elevations) on page 2-5 of the ACSS Pilot's Guide should be as follows:

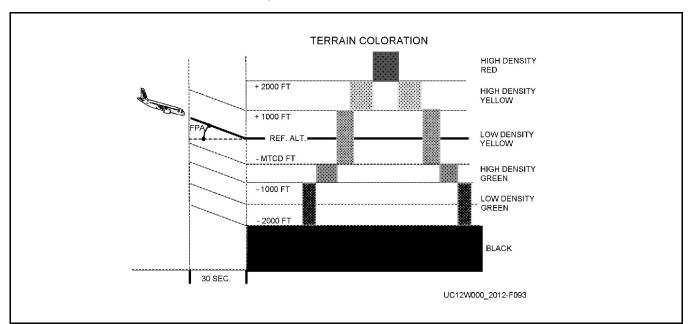


Figure 18-7. Terrain Coloration

3. The following table replaces Table 2-1 (Terrain Display Patterns for Various Terrain Elevations) on page 2-7 of the ACSS Pilot's guide:

TERRAIN ELEVATION (TYPICAL VALUES)	TERRAIN COLOR	DOT DENSITY
2,000 ft or more above the airplanes reference altitude	Red	High
1,000 ft to 2,000 ft above the airplanes reference altitude	Yellow	High
Maximum of 500 ft (MTCD) below the airplanes reference altitude to 1,000 ft above the airplanes reference altitude	Yellow	Low
Maximum of 500 ft (MTCD) to 1,000 ft below the airplanes reference altitude	Green	High
1,000 ft to 2,000 ft below the airplanes reference altitude	Green	Low
2,000 ft or greater below the airplanes reference altitude	Black	N/A
Invalid terrain cell	Magenta	Solid
Terrain Caution	Yellow	Solid
Terrain Warning	Red	Solid
Avoid Terrain	Red/Black	Black with red cross-hatch

4. The following table replaces Table 2-2 (Obstacle Display Patterns for Various Obstacle Elevations) on page 2-9 of the ACSS Pilot's Guide:

OBSTACLE ELEVATION (TYPICAL VALUES)	OBSTACLE COLOR	DOT DENSITY
2,000 ft or more above the airplanes reference altitude	Red	High
1,000 ft to 2,000 ft above the airplanes reference altitude	Yellow	High
Maximum of 500 ft (MTCD) below the airplanes reference altitude to 1,000 ft above the airplanes reference altitude	Yellow	Low
Maximum of 500 ft (MTCD) to 1,000 ft below the airplanes reference altitude	Green	High
1,000 ft to 2,000 ft below the airplanes reference altitude	Green	Low
2,000 ft or greater below the airplanes reference altitude	Black	N/A
Obstacle Caution	Yellow	Solid
Obstacle Warning	Red	Solid
Avoid Obstacle	Red/Black	Black with red cross-hatch

The following information supplements the two documents listed at the beginning of paragraph 18.11.2.

The TAWS+ is powered from the Right Generator Avionics Bus and is protected by a 3-amp circuit breaker, placarded TAWS and located on the Right Circuit Breaker Panel (Figure 2-22).

The system operates by accepting a variety of airplane parameters as inputs, applying alerting algorithms, and providing the flight crew with data (aural alert messages, visual annunciations and displays) in the event that the boundaries of any alerting envelope are exceeded. The system performs the following functions:

- 1. Processes inputs from airplane systems.
- 2. Correlates current airplane position to terrain and airport databases.
- 3. Projects the terrain hazards along the projected flight path ahead of the airplane.
- 4. Generates an image of potential terrain hazards for display to the flight crew.
- 5. Generates applicable alerts and warnings, both aurally and visually, to the flight crew.

The TAWS+ is designed to be fully compatible with airplane operations. Unwanted alerts will be very rare if the pilot maintains situational awareness with respect to terrain. There is normally no requirement for the pilot to input to the system, except for preflight self-testing.

18.11.2.1 Basic Ground Proximity warnings

The following operating modes generate the following cautions and warnings as part of the basic (non-enhanced) ground proximity warning system. Several of the modes present an initial caution to alert crew of a developing problem that requires their attention. If the situation worsens, a warning is generated to alert the crew to provide increased correction.

The following messages and aurals are provided for TAWS+ Modes 1-6. See Chapter 12, Emergency Procedures, and Chapter 13, Abnormal Procedures, for the appropriate procedure associated with each caution and warning alert.

MODE	FUNCTION	PFD CAUTION MESSAGE (YELLOW)	CAUTION AURAL	PFD WARNING MESSAGE (RED)	WARNING
1	Excessive Descent Rate	GND PROX	"SINK RATE"	PULL UP	"PULL UP"
2	Excessive Closure on Terrain	GND PROX	"TERRAIN, TERRAIN"	PULL UP	"PULL UP"
3	Altitude Loss After Takeoff	GND PROX	"DON'T SINK, DON'T SINK"	N/A	N/A
4a	Unsafe Terrain Clearance	GND PROX	"TOO LOW GEAR"	N/A	N/A
4b	Unsafe Terrain Clearance	GND PROX	"TOO LOW FLAPS"	N/A	N/A
5	Excessive Glideslope Deviation	GND PROX	"GLIDESLOPE"	N/A	N/A
6a	Excessive Bank Angle	N/A	"BANK ANGLE"	N/A	N/A
6b	Altitude Callouts	N/A	"500, 200, 100, 50, 40, 30, 20, 10"	N/A	N/A
6f	Selected MDA	N/A	"MINIMUMS, MINIMUMS"	N/A	N/A

18.11.2.2 GPWS Functions

The following equipment is required to be operational for the proper functioning of Mode 1 through 6 of the ACSS TAWS+ system:

- 1. TAWS+ Warning System Computer.
- 2. Radio Altimeter.
- 3. Vertical Speed from the Air Data Computer.
- 4. Airspeed from the Air Data Computer.
- 5. Glideslope and Localizer Deviation.
- 6. Landing Gear Position.
- 7. Flap Position.
- 8. Roll attitude from Pilot's Attitude System (for "BANK ANGLE" aural message).
- 9. Decision Height System (for "MINIMUMS" aural message).

The following Mode 6 advisory callouts are enabled: "FIVE HUNDRED", "TWO HUNDRED", "ONE HUNDRED". "FIFTY", "FORTY", "THIRTY", "TWENTY", "TEN", and "MINIMUMS".

The following three pushbutton switch/annunciators for TAWS+ are located directly in front of the pilot:

SWITCH/ ANNUNCIATOR	COLOR ACTIVE STATE	FUNCTION
FLAP OVRD	AMBER	Pressing the switch disables the "TOO LOW FLAPS" portion of the GPWS Mode 4b alert boundaries and also selects the Mode 2b envelope. The "ACTIVE" annunciator illuminates when the switch is pressed.
G/S INHIB	AMBER	Illuminates to indicate the GPWS Mode 5 glideslope alert has been inhibited. Pressing the switch on the ground initiates self-test. The "ACTIVE" annunciator illuminates amber momentarily when pressed and then extinguishes when released. However, the glideslope alerting will remain inhibited although the "ACTIVE" legend will be extinguished. The inhibit function is enabled below 2,000 ft AGL and disabled at 30 ft AGL or after ascending above 2,000 ft AGL.
TERR INHIB	AMBER	Pressing the switch deselects all CPA functions of the TAWS+ system. The "ACTIVE" annunciator illuminates when the switch is pressed.

If terrain data penetrates the caution or warning envelopes, then the corresponding aural and visual alerts are generated.

Terrain display can be selected manually anytime. Areas of terrain sufficiently close to the airplane, that do not penetrate the terrain caution or warning envelopes are depicted by areas of red, yellow or green dot patterns. The color and dot density vary based on terrain elevation relative to the airplane. Magenta coloring is use to indicate areas where terrain information is unavailable.

Note

If the terrain is within 15 nm of the nearest airport, terrain with an elevation of less than the nearest runway elevation of +400 feet is displayed in black.

The following annunciators, aural alerts, and aural warnings are provided for the CPA function of TAWS+. See Chapter 12, Emergency Procedures, and Chapter 13, Abnormal Procedures, for the appropriate procedure associated with each alert and warning.

FUNCTION/ MODE	PFD CAUTION MESSAGE (YELLOW)	CAUTION AURAL	PFD WARNING MESSAGE (RED)	WARNING
Terrain Alerting and Display	GND PROX	"CAUTION TERRAIN, CAUTION TERRAIN"	PULL UP	"TERRAIN, TERRAIN, PULL UP, PULL UP"
	GND PROX	"CAUTION OBSTACLE, CAUTION OBSTACLE"	PULL UP	"OBSTACLE, OBSTACLE, PULL UP, PULL UP"
	GND PROX	"CAUTION TERRAIN" OR "CAUTION OBSTACLE"	PULL UP	"AVOID OBSTACLE" OR "AVOID TERRAIN"
Premature Descent Alerting (PDA)	GND PROX	"TOO LOW N/A N/A TERRAIN"		N/A

18.11.2.3 TAWS+ Functions

The following equipment must be operational for the proper functioning of the predictive features of the TAWS+:

- 1. TAWS+ Warning Computer.
- 2. Heading from the No. 1 Compass System (used for Terrain display only).
- 3. GPS position.
- 4. Terrain and Airport Database.

The following predictive features are available:

- 1. Terrain Display.
- 2. Collision Prediction and Alerting (CPA).

18.11.2.4 Obstacles

Obstacles in the database are defined as those man-made obstacles such as towers, buildings and antennas. An obstacle has a height of at least 250 feet. If activated, the obstacle database has the same alert displays as the terrain database ("CAUTION OBSTACLE", "OBSTACLE AHEAD, PULL UP", "AVOID OBSTACLE") and can be inhibited by selection of the TERR INHIB switch/annunciator.

Note

With Terrain selected to be displayed on any cockpit display, usually when display ranges of 200 nm or greater are selected, it may be possible for a short line of red pixels to appear in front of the wing of the displayed aircraft symbol. These red pixels are not associated with a TERRAIN or OBSTACLE warning and have a different appearance to the solid red square associated with a TERRAIN or OBSTACLE warning. This display anomaly may disappear and reappear at random intervals. If this occurs, select a lower range display and ensure the red area disappears from the display. If any red is displayed and a TERRAIN or OBSTACLE warning is issued, suitable avoiding action must be taken.

18.11.3 Electronic Standby Instrument System (ESIS)

The Goodrich Model GH-3100 Electronic Standby Instrument System is located in the center of the instrument panel. The ESIS is a full-color, active matrix LCD which provides the following information:

- 1. Attitude.
- 2. Altitude.
- 3. Airspeed.
- 4. Heading.
- 5. Barometric Pressure.
- 6. NAV 1 (NOTE: This information will be available until the airplane battery is depleted. DME will not be available if power is lost to the Left Generator Avionics Bus. This bus is manually shed after a dual generator failure).

The system consists of the display, a standby battery, a magnetometer, and a configuration module. The display is protected by a 3-amp circuit breaker, placarded, ESIS DISP. A switch, placarded ESIS-ON-OFF-TEST, is located on the Left Subpanel (Figure 2-4). Two indicator lights are installed immediately adjacent to the switch. During normal operation, this switch is in the ON position and both lights are extinguished. In the event that power is lost from the Left Generator Bus, the standby battery will provide power to the ESIS system causing an amber light to

illuminate. Illumination of this light indicates the ESIS system is using the standby battery. During operations with the amber light illuminated the standby battery is not being recharged by the airplane system.

The ESIS standby battery can be tested prior to powering up the airplane by momentarily holding the ESIS-ON-OFF-TEST switch in the TEST position. A green light will illuminate indicating a successful standby battery test.

The ESIS system does not incorporate an aural warning if the red V_{MO}/M_{MO} marker on the airspeed scale is exceeded.

The altitude display is corrected for static system errors in the same manner as the pilot and copilot altitude displays.

The altitude display is not approved for use in RVSM airspace. Refer to the latest version of the Goodrich GH-3100 ESIS Pilot's Guide P/N TP-560 for further information.

CHAPTER 19

Transponder/IFF

19.1 TRANSPONDERS

There are two Air Traffic Control (ATC) transponders installed in the UC-12W aircraft.

The TDR-94D is installed as the ATC #1 transponder. It is an integral part of the Air Traffic Control Radar Beacon System. It provides identification of this aircraft on the ATC ground controller's plan position indicator (PPI) with pressure altitude. The TDR-94D operates in Mode Select to provide a unique aircraft address identification code, as well as air to air and air to ground interrogation replies. The unit also has data link capability, which allows it to perform additional ATC and air separation assurance functions. The TDR-94D is controlled by either CDU as ATC 1. Refer to the Rockwell Collins Pro Line 21 Operator's Guide for transponder control and operation.

The AN/APX-119 IFF transponder is the ATC #2 transponder installed in the UC-12W aircraft.

Both transponders satisfy the Enhanced Surveillance parameters listed in paragraph 4.30.9 Mode S Enhanced Surveillance.

19.2 AN/APX-119 TRANSPONDER (IFF)

19.2.1 Description

The APX-119 IFF transponder replaces the existing No. 2 Collins TDR-94 transponder and provides the same capabilities with the additional capability of Mode 4 IFF. A dedicated IFF control is located in the cockpit pedestal and provides all functionality along with TCAS II control when selected via an external cockpit mounted switch. The IFF transponder provides cooperative Mark XII Identification Friend or Foe (IFF) capability using full diversity selection, as well as Mode Select (Mode S) capability. In addition, transponder operation provides interface capability with the aircraft's Traffic Collision and Avoidance System (TCAS).

The IFF transponder system is made up of a transponder, two antennas, a crypto applique, and a control panel. The TWR receives power from the Triple-Fed Bus and is protected by a 5-ampere circuit breaker located on the auxiliary circuit breaker panel and labeled IFF XPNDR. An IFF annunciator illuminates to warn the flightcrew when the IFF system becomes inoperative.

19.2.2 Transponder

The digital transponder is a remote-mounted receiver-transmitter unit. The transponder is controlled and monitored by a separate IFF/Mode S/TCAS control panel via an RS-485 serial link. Interrogations received by the transponder are amplified, video processed, and then decoded. The transponder's front panel interface incorporates the dedicated serial bus from the control panel.

19.2.3 Crypto Applique

The crypto applique is a compact, easily removable Mode 4 Computer that when installed into the transponder provides Mode 4 capability. The front panel of the crypto applique includes a FILL connector used to load key variables, a FILL PASS indicator to show Mode 4 keys are properly loaded, and a ZEROIZE pushbutton switch to zeroizes Mode 4 keys.

19.2.4 Antennas

Two antennas and associated cabling provide the radio frequency link for reception of IFF interrogations and transmission of replies by the digital transponder. One antenna is located on top of the aircraft and the second antenna is located on the bottom of the aircraft.

19.2.5 Control Panel

The control panel contains the controls and indicators required for operation of the transponder. The controls are used to enable, disable, or modify the operation of the transponder. Information pertaining to the operational configuration or status of the transponder is indicated on an eight character alphanumeric display. Refer to Figure 19-1 for the identification and function of each operating control and indicator on the control panel.

19.2.6 Power-On Initialization

Upon application of power to the control panel, a power-on initialization test is executed. This test serves as a confidence check on the control panel hardware. A CP Pass/FAIL indication is provided on the control panel's alphanumeric display when the test is complete. A comprehensive control panel built-in test (BIT) is available in the Maintenance Menu (SEL B). Once the power-on initialization is complete, the current Mode 3/A code appears in the alphanumeric display.

19.3 MENUS

Menu functions are available through a "soft" menu and viewed on the alphanumeric display. The soft menu allows modification to operational modes, code data, and maintenance functions. The SEL A/SEL B switch allows selection and modification of operational modes and data. The SEL A menu (Mission Menu) contains operational selections considered typical mission functions and may be frequently used or modified during mission execution. The SEL B menu (Maintenance Menu) contains those selections considered maintenance functions. Maintenance functions are typically functions that do not, or infrequently, change during mission execution. Maintenance functions provide a means to check the control panel operational status and make semi-permanent changes to the operational modes. Momentary selection of either SEL A or SEL B causes the display to increase to the next logical menu display.

19.3.1 SEL A (Mission Functions)

The list below indicates the functions available for display or modification through momentary activation of the SEL A Mission Menu selection switch.

- 1. Mode 3/A data.
- 2. Mode 1 data.
- 3. E-TCAS.
- 4. Formation Member (FMCODES).
- 5. ATC.
- 6. Broadcast.

An asterisk (*) appears in the left-most character position on the alphanumeric display while mission functions are displayed if E-TCAS is on, ATC is off, Broadcast is off, Mode S is disabled, or Antenna Test is enabled (or any combination).

Figure 19-1. Control Panel

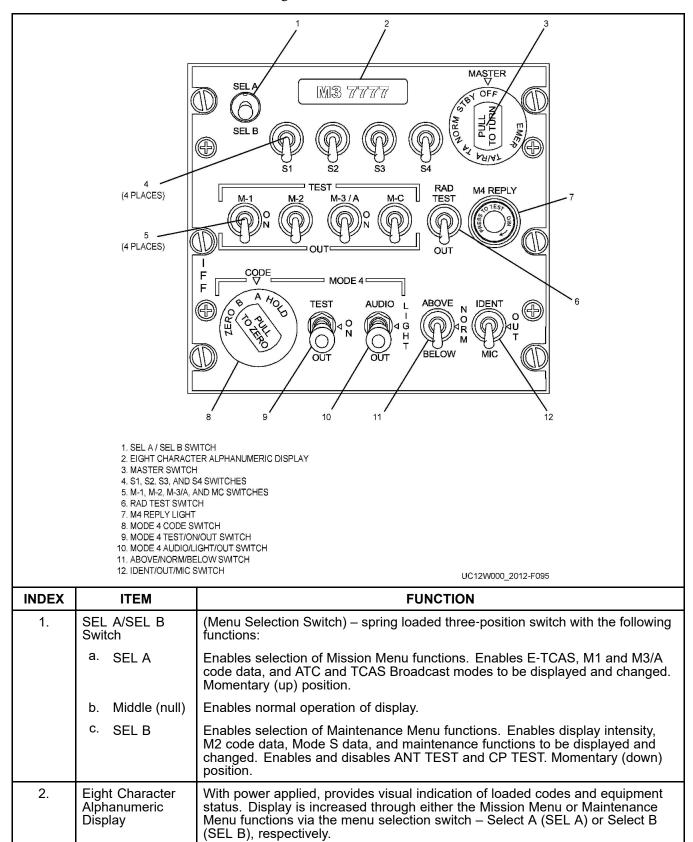


Figure 19-1. Control Panel (cont.)

INDEX	ITEM	FUNCTION		
3.	MASTER Switch	A six-position, pull-to-turn, rotary switch with following functions:		
	a. OFF	Removes power from control panel and transponder (protected pull-to turn).		
	b. STBY	Applies power to control panel and transponder, but disables transponder from transmitting. Control panel is operational and monitors the operator's selections. Puts TCAS in Standby.		
	c. NORM	NORM — Enables transponder to reply to all enabled modes (M-1, M-2, M-3/A, M-C, M-4 or M-S). Puts TCAS in Standby. Returns FAIL message if BIT is run in STBY. Mode S defaults to "enabled" during power-up if aircraft is on the ground (Mode S Air/Ground signal).		
	d. TA	Enables transponder to reply to all enabled modes (M-1, M-2, M-3/A, M-C, M-4 or M-S). Enables TCAS processor, if installed, to provide Traffic Advisory (TA) warnings.		
	e. TA/RA	Enables transponder to reply to all enabled modes (M-1, M-2, M-3/A, M-C, M-4 or M-S). Enables TCAS processor, if installed, to provide Traffic Advisory and Resolution Advisory (RA) warnings.		
	f. EMER	Enables transponder to generate an emergency code in all SIF modes and Mode S. In addition, the TCAS processor will be enabled to operate in TA mode (if operational) (protected pull-to-turn).		
4.	S1, S2, S3, S4 Switches	Spring loaded three-position switches with the following functions:		
	a. _{Up}	Increases information on eight-character display. When held in up position, continuously increases displayed information. When momentarily held in up position, provides single increase.		
	b. Middle	Disables update of display information. Normal switch position.		
	c. Down	Decreases information on eight-character display. When held in down position, continuously decreases displayed information. When momentarily held in down position, provides single decrease.		
5.	M-1, M-2, M-3/A, M-C Switches	Three-position switches with the following functions:		
	a. TEST	Enables transponder to perform self-test in selected mode. During TEST, the selected mode is radiated. If self-test is initiated with MASTER switch in STBY, FAIL message will be displayed. Momentary switch position.		
	b. ON	Enables respective mode. Normal switch position.		
	c. OUT	Disables respective mode. Transponder will not reply to interrogations in the disabled mode.		
6.	RAD TEST Switch	A spring loaded two-position switch with the following functions:		
	a. RAD TEST	When held in up (RAD TEST) position, enables the transponder to reply to Mode 4 interrogations with a "Verify Bit 1" set. When momentarily pressed to up position, overrides the on-the-ground reply inhibit to Mode 3/A, Mode C, ATCRBS/Mode S All-Call, and Mode S only All-Call interrogations. Each time the RAD TEST switch is momentarily pressed up, the transponder will override the on-the-ground reply inhibit for 1 minute (up to 5 minutes total).		
	b. OUT	Enables normal transponder operation. Normal switch position.		
7.	M4 REPLY Light	Indicator, Provides visual indication of Mode 4 reply being transmitted (press to test; turn clockwise to dim). Disabled when MODE 4 AUDIO/ LIGHT/OUT switch is set to OUT.		

Figure 19-1. Control Panel (cont.)

INDEX	ITEM	FUNCTION
8.	MODE 4 CODE Switch	A four-position rotary switch with the following functions:
	a. ZERO	Clears Mode 4 code held in Crypto Appliqué or external Mode 4 Computer. Pull to rotate to (protected) position.
	b. B	Selects next code period.
	c. A	Selects current code period.
	d. HOLD	Activates Mode 4 code hold logic in Crypto Appliqué or external Mode 4 Computer, which prevents the loss of Mode 4 key if power is removed and landing gear has cycled (up and down). If HOLD is activated, Mode 4 key may only be zeroized by manually selecting ZEROIZE on Crypto Appliqué or external Mode 4 Computer, or by selecting ZERO on this switch. Momentary switch position.
9.	MODE 4 TEST/ON/ OUT Switch	A three-position switch with the following functions:
	a. TEST	Enables transponder to perform Mode 4 self-test. During TEST, Mode 4 code is not radiated. Momentary switch position.
	b. ON	Enables Crypto Appliqué or external Mode 4 Computer to reply to compatible Mode 4 interrogations. Normal switch position.
	c. OUT	Disables Mode 4 operations. When Mode 4 interrogations are received, transponder will not reply and a Mode 4 Caution will be sent to platform warning panel (provided Crypto Appliqué or external Mode 4 Computer is installed).
10.	MODE 4 AUDIO/ LIGHT/OUT Switch	A three-position switch with the following functions:
	a. AUDIO	Enables Mode 4 REPLY light and Mode 4 audio tone.
	b. LIGHT	Enables Mode 4 REPLY light; disables Mode 4 audio tone.
	c. OUT	Disables Mode 4 REPLY light and Mode 4 audio tone.
		Note
		Mode 4 Caution light is enabled at all times. If Mode 4 is in use, the MODE 4 AUDIO/LIGHT/OUT switch should always be set to LIGHT or AUDIO.
11.	ABOVE/NORM/ BELOW Switch	A three-position switch with the following functions:
	a. TCAS	(1) ABOVE: Display altitude volume is -2,700 to 8,700 ft. (2) NORM: Display altitude volume is -2,700 to 2,700 ft. (3) BELOW: Display altitude volume is -8,700 to 2,700 ft.
	b. LIGHT	Enables Mode 4 REPLY light; disables Mode 4 audio tone.
	c. OUT	Disables Mode 4 REPLY light and Mode 4 audio tone.
		Note
		Mode 4 Caution light is enabled at all times. If Mode 4 is in use, the MODE 4 AUDIO/LIGHT/OUT switch should always be set to LIGHT or AUDIO.

Figure 19-1. Control Panel (cont.)

INDEX	ITEM	FUNCTION
12.	IDENT/OUT/MIC Switch	A three-position switch with the following functions:
	a. IDENT	Enables transponder to reply with Special Position Identification (SPI) pulse for 15 to 30 seconds. Momentary switch position.
	b. OUT	Disables generation of SPI pulse. Normal switch position.
	c. MIC	Each time microphone is keyed, enables transponder to reply with SPI pulse for 15 to 30 seconds.

19.3.2 SEL B (Maintenance Functions)

The list below indicates the functions available for display or modification through momentary activation of the SEL B Maintenance Menu selection switch.

- 1. TCAS Range.
- 2. Display Brightness.
- 3. Mode 2 Codes.
- 4. Mode S Enable/Disable.
- 5. Mode S Flight Identification.
- 6. RT Type.
- 7. Antenna Test.
- 8. Control Panel Self-Test.

An asterisk (*) appears in the left-most character position on the alphanumeric display while mission functions are displayed if E-TCAS is on, ATC is off, Broadcast is off, Mode S is disabled, or Antenna Test is enabled (or any combination).

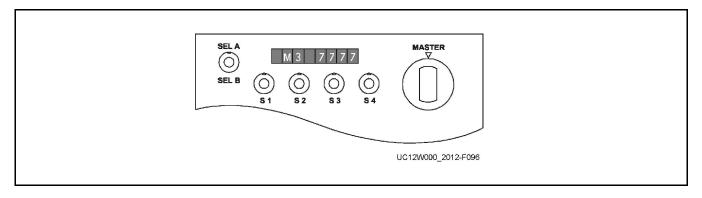
19.3.3 Menu Definitions - SEL A (Mission Menu)

19.3.3.1 Mode 3/A (M3) Code

The Mode 3/A code is stored in non-volatile RAM and restored after power-on and power dropouts. Once the power-on initialization test is complete, the alphanumeric display shows the current Mode 3/A code or last saved Mode 3/A code (Figure 19-2). Selectable Mode 3/A codes are 0000 to 7777. Switches S1 through S4 are used to change codes from 0 to 7. Switch S1 changes the first digit from the left (0123), S2 changes the second digit from the left (0123), S3 changes the third digit from the left (0123).

Momentarily pressing the menu selection switch to SEL A triggers the alphanumeric display to scroll to the next Mission Menu selection, indicating the current Mode 1 code.

Figure 19-2. Alphanumeric Display — Mode 3/A



19.3.3.2 Mode 1 (M1) Code

Selectable Mode 1 codes are 0000 to 7300 (Figure 19-3). Switches S1 and S2 are used to change code digits. Switch S1 changes the left-most digit (7300), and S2 changes the second digit from the left (7300). The two right-most digits are set to 0, and both S3 and S4 are ignored.

When no strapping is implemented, momentarily pressing the menu selection switch to SEL A triggers the display to scroll to the next Mission Menu selection, indicating the current status of E-TCAS mode.

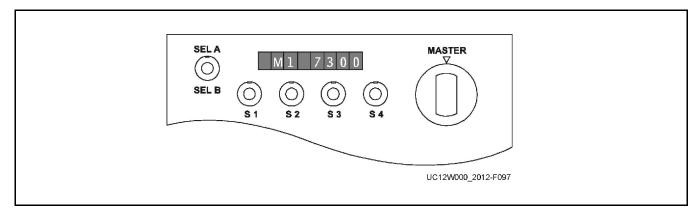
19.3.3.3 E-TCAS (ETCS)

With the alphanumeric display indicating ETCS, the current operational mode of E-TCAS will also be displayed (ON or OF (OFF)) (Figure 19-4). Momentarily pressing switch S1, S2, S3 or S4 (up or down) toggles the display between ETCS ON and ETCS OF.

E-TCAS operates independently of all other modes. ETCS ON enables the E-TCAS mode of operation in the E-TCAS processor. ETCS OF disables the E-TCAS mode of operation in the E-TCAS processor. E-TCAS is disabled automatically when Mode S is disabled. When Mode S is re-enabled, E-TCAS remains in its present operational mode.

Momentarily pressing the menu selection switch to SEL A triggers the display to scroll to the next Mission Menu selection, FMCODES.

Figure 19-3. Alphanumeric Display — Mode 1



SEL A

SEL B

SE

Figure 19-4. Alphanumeric Display — E-TCAS

19.3.3.4 Formation Member Codes (FMCODES)

The FMCODES selection in the Mission Menu provides for Mode 3/A code entry, review, and storage regardless of the E-TCAS status (ETCS ON or ETCS OF). When E-TCAS is enabled, the control panel retrieves the codes from storage and provides them to the transponder via the RS-485 serial data bus during normal messaging sequence.

With the display indicating FMCODES (Figure 19-5), momentarily pressing switch S1, S2, S3 or S4 (up or down) causes the display to scroll to the first Formation Member code location (Figure 19-6). Up to 30 Formation Member codes can be entered. The code used represents the Mode 3/A code of the Formation Member(s). If no codes are entered, a null record is sent to the transponder. When no strapping is implemented, the FM code entry mode will be terminated when the menu selection switch is momentarily set to SEL A and the display returns to the next Mission Menu selection, ATC mode status (off or on).

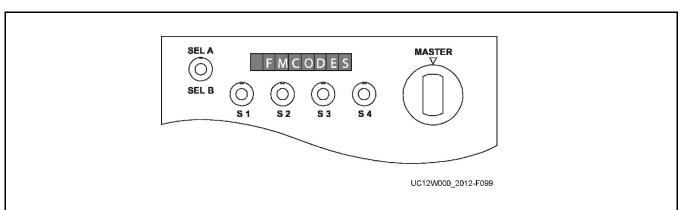


Figure 19-5. E-TCAS Formation Member Menu

19.3.3.5 Formation Member Code Entry

With the display indicating a Formation Member Mode 3/A code, the code can be modified using the code select switches as defined in Figure 19-6 below:

ITEM **FUNCTION** COMMENT S1 Add or Delete Member code - Add code if no code exists D — Delete code if code exists S2 Acknowledge Addition or Deletion of member Acknowledge execution of Add or Delete code function S3 Increase/decrease digit Change code digit S4 Shift "*" to character position Shift "*" to digit position to be modified SEL B Increases display to next sequence number Displays #02 7777 to be updated of Formation Member

Figure 19-6. FM Code Switch Definitions

19.3.3.5.1 FM Code Format

The operator will be prompted by the display to enter the Formation Member Mode 3/A codes in the form "#nn ABCD", where nn is the Formation Member list number (01-30) and ABCD is 1 of 4096 possible Mode 3/A codes. As each code is entered, the control panel stores them in pre-designated locations in its non-volatile RAM. This process continues until the operator exits the entry mode or until all FM codes have been entered. Momentarily pressing the menu selection switch to SEL A exits the FM code entry mode and the display scrolls to the next Mission Menu selection, ATC mode status.

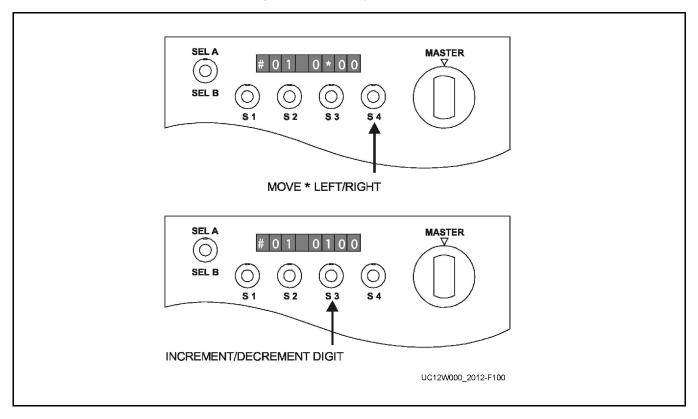
19.3.3.5.2 Review FM Codes

With the Mission Menu display indicating FMCODES, momentarily pressing switch S1, S2, S3 or S4 (up or down) scrolls the display to the first FM code. Momentarily pressing the menu selection switch to SEL B triggers the display to scroll to the next FM code. When the last entered code is encountered, momentarily pressing the menu selection switch to SEL B triggers the display to wrap around to the first FM code (#01 ABCD). During the review process, any code may be modified by following the code modification procedure outlined below. If no additional FM code review is required, the operator may modify an FM code, add an FM code, delete an FM code, or exit the FM code entry mode (SEL A).

19.3.3.5.3 Modify an FM Code

With the Mission Menu display indicating FMCODES, momentarily pressing switch S1, S2, S3 or S4 (up or down) scrolls the display to the first FM code. Momentarily pressing the menu selection switch to SEL B triggers the display to scroll to the next Formation Member Mode 3/A code. This allows the operator to scroll to the desired FM code. The code may be modified using the S4 switch to indicate the desired digit to be modified and the S3 switch to increase or decrease the digit (Figure 19-7). To display the next FM code, momentarily press the menu selection switch to SEL B. If no additional FM code modifications are required, the operator may review the FM codes, add an FM code, delete an FM code, or exit the FM code entry mode (SEL A).

Figure 19-7. Modify an FM Code



19.3.3.5.4 Add an FM Code

If no code exists in the current FM code location, the display will indicate the FM list number (Figure 19-8). If the operator desires to enter an FM code in the present location, momentarily pressing the S1 switch (up or down) will modify the display by changing the left-most character to an "A", indicating ADD (Figure 19-9). This signifies the operator is about to add a Mode 3/A code. To execute this command, operator acknowledgement is required by momentarily pressing the S2 switch (up or down), whereupon the display will indicate #nn 0000 (Figure 19-10). This code may then be modified using the procedure in paragraph 19.3.3.5.3 above. If no additional FM codes are required, the operator may review the FM codes, modify an FM code, delete an FM code, or exit the FM code entry mode (SEL A).

Figure 19-8. Formation Member Code Location

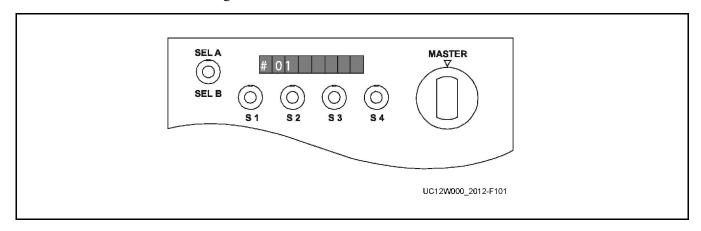


Figure 19-9. Add Formation Member Mode 3/A Code

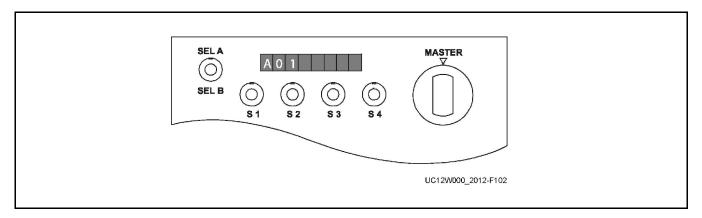
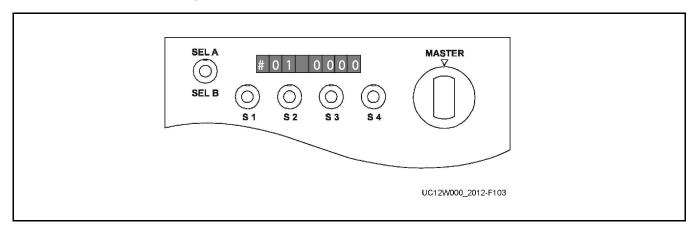


Figure 19-10. Initial Formation Member Mode 3/A Code



19.3.3.5.5 Delete an FM Code(s)

The operator may delete one or more pre-existing FM codes using a similar key sequence as detailed above. With the Mission Menu display indicating FMCODES, momentarily pressing switch S1, S2, S3 or S4 (up or down) will scroll the display to the first FM code. To delete the current code, momentarily pressing the S1 switch (up or down) will modify the display by changing the left-most display character to a "D", indicating DELETE (Figure 19-11). This signifies the operator is about to delete the current FM code. To execute this command, operator acknowledgement is required by momentarily pressing the S2 switch (up or down). Once the code is deleted, it cannot be undeleted. Any FM codes stored after the deleted FM code will automatically decrease by one position in the FM list and the display will be updated to indicate the next FM code, if any. If no additional FM codes deletions are required, the operator may review the FM codes, modify an FM code, add an FM code, or exit the FM code entry mode (SEL A).

19.3.3.6 ATC

The ATC mode is an independent function used in conjunction with formation missions. With the display indicating ATC and the current operational status, momentarily pressing switch S1, S2, S3 or S4 (up or down) will cause the alphanumeric display to toggle between ATC ON or ATC OF (Figure 19-12).

Selection of ATC OF inhibits the transponder's replies to interrogations for Mode 3/A, Mode C, Mode S All-Call, and Mode S UF11 (ground interrogations), overriding their previous operational state. Selection of ATC ON restores the previous operational state for Mode S, Mode S All-Call, and Mode S UF11. The operational states of Modes 3/A and C are dependent on the control panel's switch position setting for the respective mode.

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Momentarily pressing the menu selection switch to SEL A causes the alphanumeric display to scroll to the next Mission Menu selection, indicating the current status of TCAS Broadcast mode (BCST).

19.3.3.7 Broadcast (BCST)

The Broadcast (BCST) mode is an independent function used in conjunction with formation missions. With the display indicating BCST and the current operational status, momentarily pressing switch S1, S2, S3 or S4 (up or down) will cause the alphanumeric display to toggle between BCST ON and BCST OF (Figure 19-13).

Figure 19-11. Delete an FM Code

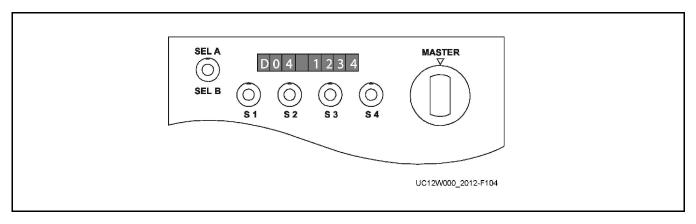
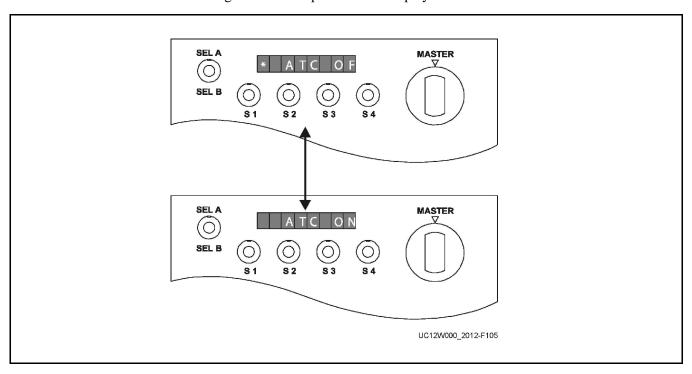


Figure 19-12. Alphanumeric Display — ATC



SELA

SELA

SELA

BCST OF

WASTER

V

SELB

SI S2 S3 S4

WASTER

V

SELB

SI S2 S3 S4

UC12W000_2012-F106

Figure 19-13. Alphanumeric Display — Broadcast

Selection of BCST OF inhibits the E-TCAS processor's broadcast interrogation transmissions. This selection is used in conjunction with formation missions. Usually Formation Members turn BCST to OFF (OF) during formation missions. Proper procedure should be followed as dictated by the Command Office. BCST OF will not affect transponder operation. Selection of BCST ON will enable the E-TCAS processor's broadcast interrogation transmissions.

Momentarily pressing the menu selection switch to SEL A causes the display to scroll back to the Mode 3/A display.

19.3.4 Menu Definitions – SEL B (Maintenance Menu)

19.3.4.1 TCAS Range Selection (RNG)

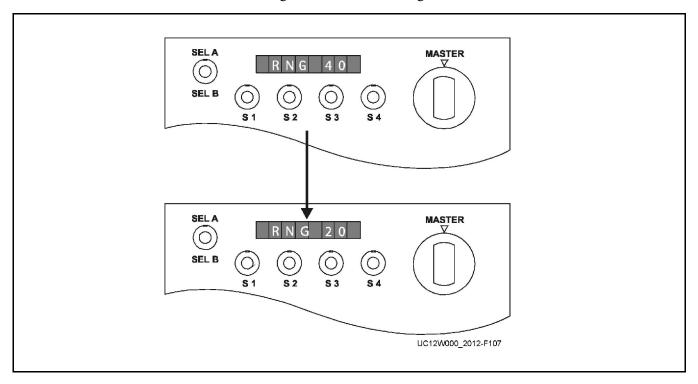
TCAS display ranges are selectable through the Maintenance Menu. The range selections are 3, 5, 10, 15, 20 and 40.

Configuration pins integrated into the control panel's main connector are available to deactivate the range selection from the Maintenance Menu. Range selection should be deactivated if the aircraft TCAS displays are configured for local range selection.

When in the Mission Menu, momentarily pressing the menu selection switch to SEL B triggers the display to scroll to the TCAS Range selection in the Maintenance Menu, RNG XX (Figure 19-14). With the display indicating the range (RNG XX), momentarily pressing switch S1, S2, S3 or S4 (up or down) will increase or decrease the TCAS Range, respectively (3, 5, 10, 15, 20, 40). The TCAS Range will be restored to the previous stored value upon application of power. A wrap-around feature is implemented to increase past range 40 to 3 and decrease past range 3 to 40.

Momentarily pressing the menu selection switch to SEL B triggers the display to scroll to the next Maintenance Menu selection, indicating the current Display Brightness (DISP) setting.

Figure 19-14. TCAS Range

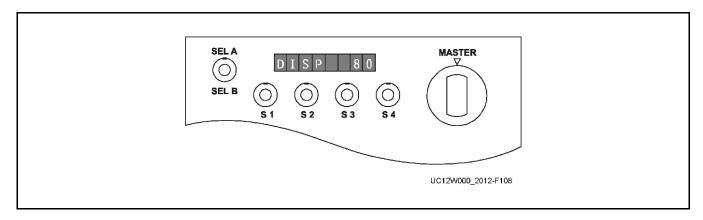


19.3.4.2 Display Brightness (DISP)

With the display indicating current display brightness (DISP XX), momentarily pressing switch S1, S2, S3 or S4 (up or down) will increase or decrease the display brightness levels, respectively (100, 80, 53, 27, 13, .10, .05) (Figure 19-15). For NVG compatibility, the previous brightness level will be restored upon application of power.

Momentarily pressing the menu selection switch to SEL B triggers the display to scroll to the next Maintenance Menu selection, indicating the current Mode 2 (M2) code.

Figure 19-15. Decrease Brightness Level (Sheet 1 of 2)



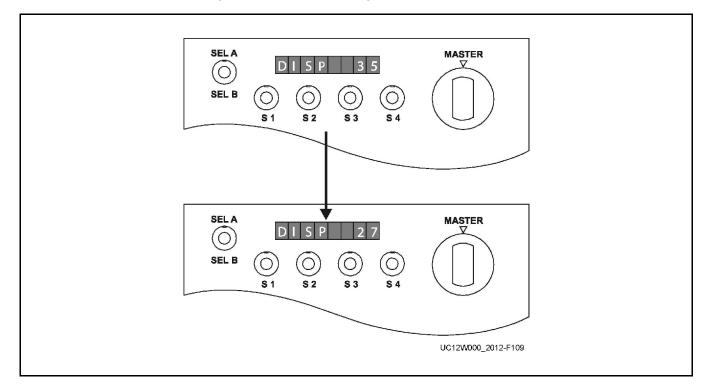


Figure 19-15. Decrease Brightness Level (Sheet 2)

19.3.4.3 Mode 2 (M2) Code

With the display indicating the current Mode 2 code, momentarily pressing switch S1, S2, S3 or S4 (up or down) will increase or decrease, respectively, the code digits (Figure 19-16). Selectable Mode 2 codes are 0000 to 7777. Switches S1 through S4 are used to change codes from 0 to 7. Switch S1 changes the first digit from the left (0123), S2 changes the second digit from the left (0123), S3 changes the third digit from the left (0123), and S4 changes the last digit from the left (0123).

Momentarily pressing the menu selection switch to SEL B triggers the display to scroll to the next Maintenance Menu selection, indicating MODE S ENABLE or DISABLE.

19.3.4.4 MODE S ENABLE/DISABLE

The display momentarily indicates MODE S (Figure 19-17, sheet 1 of 2), then automatically scrolls to indicate the current Mode S operational status (ENABLE or DISABLE). Momentarily pressing switch S1, S2, S3 or S4 (up or down) toggles the display between ENABLE and DISABLE (Figure 19-17, sheet 2 of 2).

The control panel defaults to ENABLE upon application of power if Air/Ground indicates on-the-ground; otherwise, it assumes its previously-saved state. This default can be overwritten in the Maintenance Menu under the Mode S selection. Selection of DISABLE will disable Mode S transmissions and cause TCAS to go into Standby.

With the display indicating MODE S ENABLE, momentarily pressing the menu selection switch to SEL B causes the alphanumeric display to scroll to the next Maintenance Menu selection, Mode S Address (MS ADDR).

With the display indicating MODE S DISABLE, momentarily pressing the menu selection switch to SEL B causes the alphanumeric display to scroll to the next Maintenance Menu selection, indicating the current RT TYPE.

Figure 19-16. Mode 2 Code

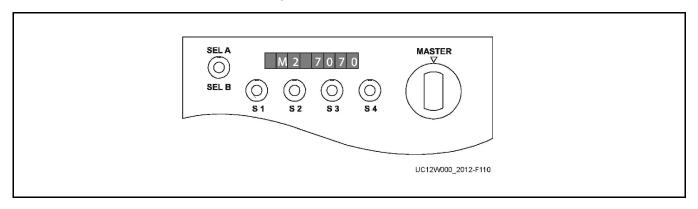


Figure 19-17. Mode S Selection (Sheet 1 of 2)

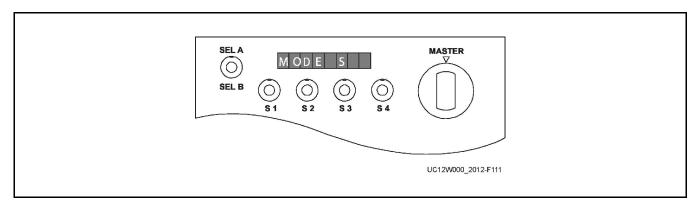
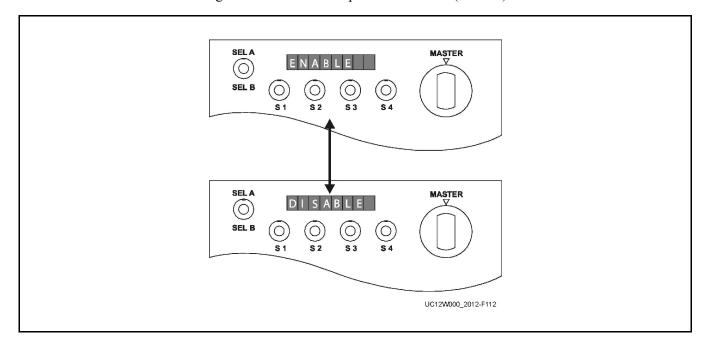


Figure 19-17. Mode S Operational Mode (Sheet 2)



19.3.4.5 Mode S Address (MS ADDR)

The display momentarily indicates MS ADDR (Figure 19-18) then automatically scrolls to indicate the current Mode S address (Figure 19-19).

With the display indicating MS ADDR, momentarily pressing the menu selection switch to SEL B causes the display to scroll to the next Maintenance Menu selection, indicating the current Mode S Flight Identification (MS FltID).

Figure 19-18. Mode S Address Selection

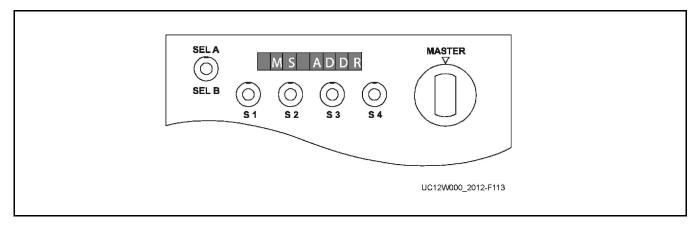
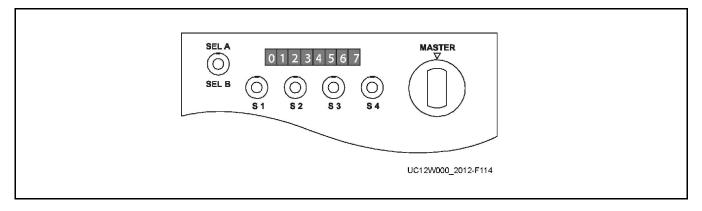


Figure 19-19. Current Mode S Address



19.3.4.5.1 Modification to Mode S Address

The control panel receives the Mode S address via hard wire strapping. The hard-wired Mode S address can be overwritten in the Maintenance Menu as described below:

1. Digit Selection.

The Digit Selection Cursor is an asterisk (*) character (Figure 19-20). Press the S1 switch (cursor appears on right side of display) up or down to move the "*" to the left. Press the S4 switch (cursor appears on left side of display) up or down to move the "*" to the right.

2. Digit Modification.

With the Digit Selection Cursor in the desired digit position, press the S2 or S3 switch up or down to change the selected digit from 0 to 7 (Figure 19-21). Pressing S2 or S3 to the up position increases the digit and pressing S2 or S3 to the down position decreases the digit.

Figure 19-20. Current Mode S Address

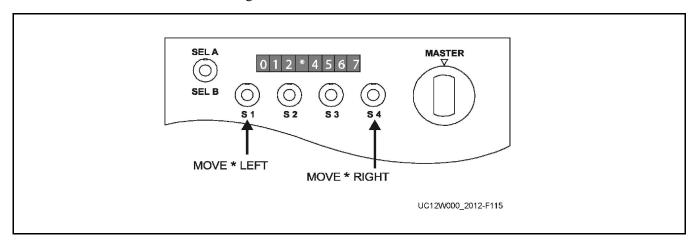
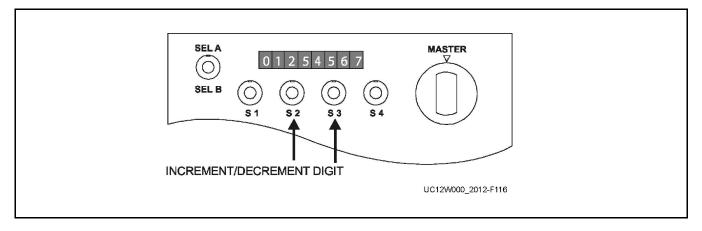


Figure 19-21. Current Mode S Address



3. Invalid Mode S Address.

A Mode S address of all zeros (0) or all sevens (7) is invalid. If an invalid Mode S address is entered, an "ADDR BAD" indication will be momentarily displayed immediately after the invalid address is entered (Figure 19-22). In addition, the transponder RT STATUS latching fault indicator will trip, displaying white and black, approximately two seconds after the invalid Mode S address is entered.

A Mode S address that has been entered via the Maintenance Menu will have precedence over the hard-wired address until power is removed. Upon power-on, the Mode S address will default to the hard-wired address (if present). The address will be indicated on the display in the Maintenance Menu under the Mode S address selection.

19.3.4.6 Mode S Flight Identification (MS FltID)

The display will momentarily indicate MS FltID (Figure 19-23), then automatically scroll to the current Mode S Flight Identification (Figure 19-24). With the display indicating MS FltID, momentarily pressing the menu selection switch to SEL B causes the display to scroll to the next Maintenance Menu selection.

Figure 19-22. Current Mode S Address

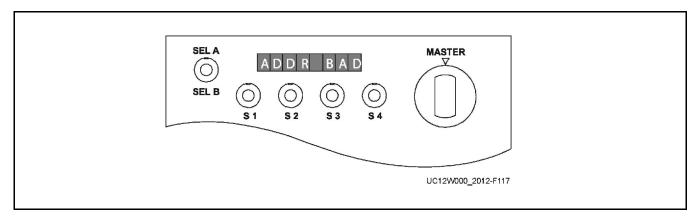


Figure 19-23. Mode S Flight Identification

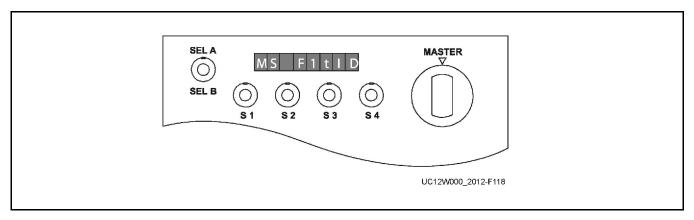
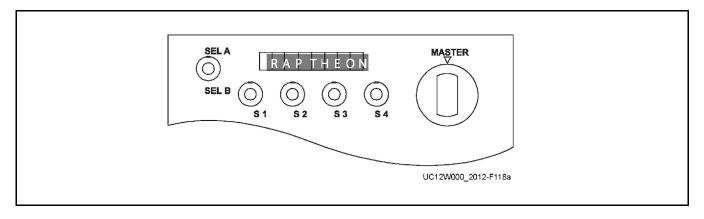


Figure 19-24. Current Mode S Flight Identification



19.3.4.6.1 Modification to Mode S Flight Identification

- 1. Character Selection.
 - The Character Selection Cursor is an asterisk (*) character (Figure 19-25). Press the S1 switch up or down to move "*" to the left. Press the S4 switch up or down to move "*" to the right.
- 2. Character Modification.

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With the Character Selection Cursor in the desired digit position, press the S2 or S3 switch (up or down) to change the selected character from 0 to Z (Figure 19-25). Pressing S2 or S3 to the up position increases the character and pressing S2 or S3 to the down position decreases the character. The sequence increasing on the display is A to Z, blank, and 0 to 9. The current Mode S flight identification will be retained in non-volatile RAM and recalled upon application of power to the control panel.

19.3.4.7 RT TYPE

The display momentarily indicates RT TYPE (Figure 19-26) then automatically scrolls, indicating the current transponder type selected (i.e., RT-1717 or RT-1853).

Note

The RT TYPE (RT-1157) selection is not available for the current aircraft configuration.

Momentarily pressing switch S1, S2, S3 or S4 (up or down) toggles the display between RT-1717 for Mode S transponder RT-1717 or RT-1853 (Figure 19-27). When RT-1717 is selected, the control panel communicates to the transponder via the RS-485 bus.

With the display indicating a transponder type, momentarily pressing the menu selection switch to SEL B causes the display to scroll to the next Maintenance Menu selection, indicating ANT TEST ENABLE or DISABLE.

19.3.4.8 Antenna Test (ANT TEST)

The display momentarily indicates ANT TEST (Figure 19-28) then automatically scrolls, indicating the current operational mode (ENABLE or DISABLE). Momentarily pressing switch S1, S2, S3 or S4 (up or down) toggles the display between ENABLE and DISABLE (Figure 19-29).

Figure 19-25. Modification to Mode S Flight Identification

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Figure 19-26. Modification to Mode S Flight Identification

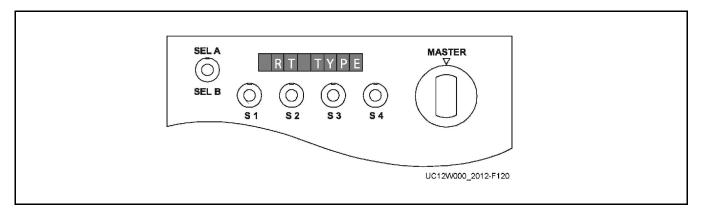


Figure 19-27. RT TYPE Selections

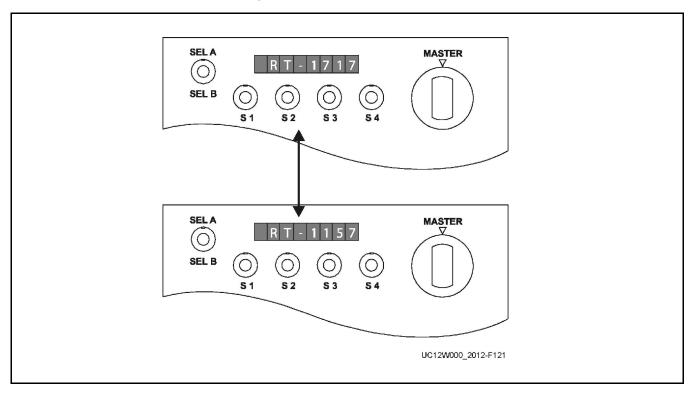


Figure 19-28. Alphanumeric Display for Antenna Test

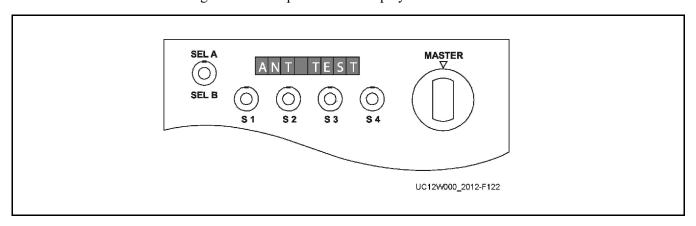
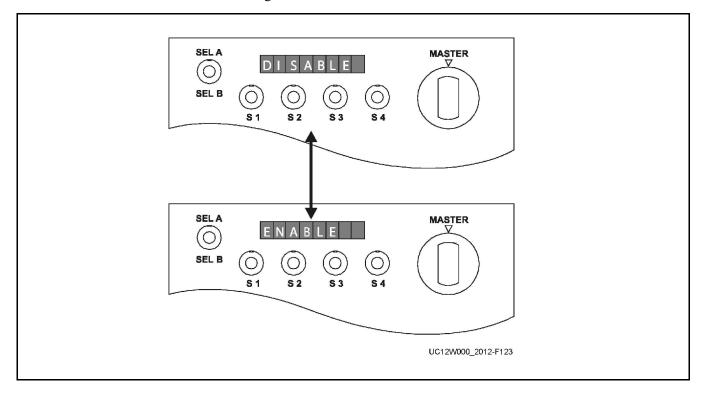


Figure 19-29. Antenna Test Status



When ANT TEST is set to ENABLE, Mode S and TCAS are automatically disabled to allow for antenna selection. With the MASTER switch set to NORM, TA, TA/RA and the ANT TEST enabled, the display will flash "ANT TEST" every 12 seconds. When the MASTER switch is set to Emergency (EMER), the antenna selection will be forced to diversity operation. When the emergency condition has cleared and the MASTER switch is returned to a normal operational mode, the ANT TEST option will default to DISABLE. With ANT TEST set to ENABLE, the ABOVE/NORM/BELOW switch on the control panel will be redefined as an antenna selection switch as follows:

- 1. ABOVE becomes Top Antenna selection.
- 2. NORM becomes Antenna Diversity selection.
- 3. BELOW becomes Bottom Antenna selection.

With ANT TEST set to ENABLE, set the ABOVE/NORM/BELOW switch to select the antenna to be tested. Momentarily hold the M-1, M-2, M-3, and M-C TEST/ON/OUT switch to the TEST position. A "Pass" indication appears on the display for each mode. All modes will be operational except where stated above for Mode S. When ANT TEST is set to DISABLE, the previous Mode S and TCAS operational mode will be restored.

With the display indicating antenna test status, momentarily pressing the menu selection switch to SEL B causes the display to scroll to the next Maintenance Menu selection, indicating control panel self-test (CP TEST).

19.3.4.9 Control Panel Self-Test (CP TEST)

With the display indicating CP TEST (Figure 19-30), momentarily pressing switch S1, S2, S3 or S4 (up or down) triggers the control panel to initiate its internal Built-In Test (BIT). When internal BIT is activated, display momentarily indicates the following messages:

- 1. "Testing" (Figure 19-31).
- 2. "CP Sw:xy" (Figure 19-32, where xy indicate the specific version number).
- 3. "RT Sw:xy" (Figure 19-33, where xy indicate the specific version number).
- 4. Display pixel checkerboard and reverse checkerboard patterns.
- 5. Display brightness level (DISP XX).
- 6. "CP Pass" (Figure 19-34).
- 7. "SW TEST" (Figure 19-35).

The BIT will be terminated and control returned to the Mode 3/A default Mission Menu display at any time when the menu selection switch (SEL A/SEL B) is set to SEL A or SEL B for a few seconds, or the MASTER switch is set to an operational mode other than Standby (STBY).

With the display indicating CP TEST, momentarily pressing the menu selection switch to SEL B for a few seconds causes the display to wrap around to the first Maintenance Menu selection, indicating the current TCAS display range (RNG XX), or display brightness (DISP XX) if TCAS range is deactivated through configuration strapping.

The conclusion of the automated portion of control panel BIT is indicated when the display momentarily displays "CP Pass" (Figure 19-34). The control panel automatically enters an interactive switch test (SW TEST) mode following automatic BIT (Figure 19-35). The switch test allows the operator to check operation of the control panel switches: M-1, M-2, M-3/A, M-C, MODE 4 TEST/ON/OUT; RAD TEST; ABOVE/NORM/BELOW; IDENT/OUT; MODE 4 AUDIO/LIGHT/OUT; and MODE 4 ZERO/B/A/HOLD.

To terminate the interactive switch test, hold the menu selection switch to SEL A or SEL B for a few seconds. The display scrolls to the next menu selection.

19.4 PRE-OPERATIONAL SETUP PROCEDURES

Perform the following procedures each time the equipment is energized to check that the transponder is connected and operating correctly.

Figure 19-30. Alphanumeric Display for the Control Panel Self-Test

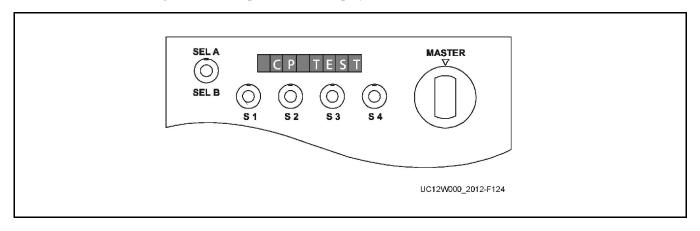


Figure 19-31. Control Panel Testing Message

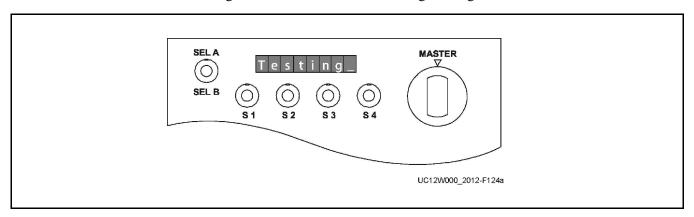


Figure 19-32. Control Panel Software Version Message

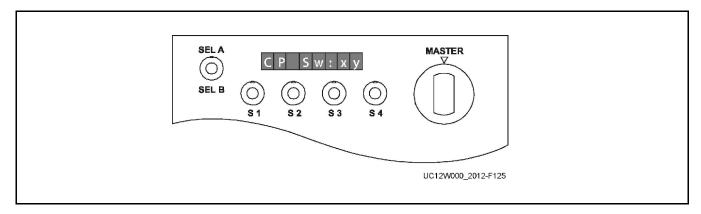


Figure 19-33. Transponder Software Version Message

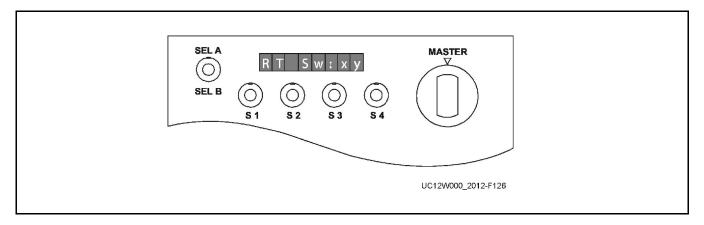


Figure 19-34. CP Pass Message

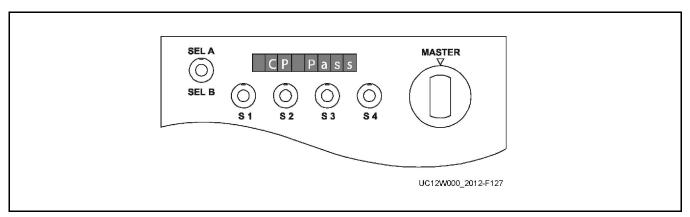
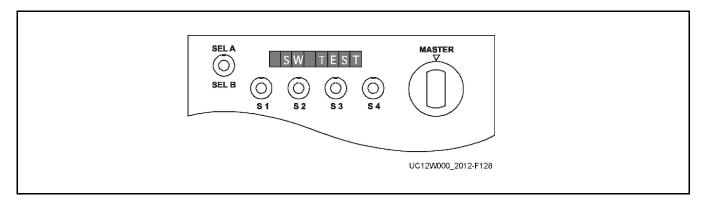


Figure 19-35. Switch Test Message



19.4.1 Mission Menu (SEL A) Selections



To prevent damage to the switch, pull outward on MASTER switch knob before turning the switch from STBY to OFF, and before turning it from TA/RA to EMER. Release the knob after the new position (OFF or EMER) is selected.

Note

Some of the selections on the following menus may cause a "*" to be displayed in the display left most character position, indicating the transponder is operating in a non-standard configuration.

- 1. Set MASTER switch to STBY. Note that the control panel displays the following messages:
 - a. Testing.
 - b. CP Pass.
 - c. M3 (Mode 3/A code).
 - d. STBY (displayed every 15 seconds).

Note

- For each Mission Menu selection, an asterisk (*) is displayed in the left-most position on the alphanumeric display when non-standard conditions are enabled/disabled.
- With MASTER switch set to STBY, display shows STBY for approximately 3 seconds, then setup information for 15 seconds. When STBY is displayed, all switches (except MASTER switch) are effectively disabled.
- 2. With MASTER switch set to STBY, the alphanumeric display shows the current or last saved Mode 3/A code (Figure 19-2). Verify Mode 3/A code is properly set. Display shows the Mode 3/A code in the form M3 ABCD, where ABCD is the code, A is the most significant number of the code, and D is the least significant number. If the Mode 3/A code needs to be modified, perform the following:

Note

The Mode 3/A code can be accessed from any menu location by holding the SEL A/SEL B switch to SEL A until the Mode 3/A code appears in the display.

- a. With M3 ABCD displayed, press the S1 switch up to increase or down to decrease the first number (most significant number) of the code.
- b. With M3 ABCD displayed, press the S2 switch up to increase or down to decrease the next number of the code.
- c. With M3 ABCD displayed, press the S3 switch up to increase or down to decrease the next number of the code.
- d. With M3 ABCD displayed, press the S4 switch up to increase or down to decrease the last number (least significant number) of the code.
- e. With desired Mode 3/A code displayed, momentarily set the SEL A/SEL B switch to SEL A; display shows current Mode 1 code.

- 3. With the display indicating current status of E-TCAS (ETCS ON or ETCS OF (OFF)), enable or disable E-TCAS as follows:
 - a. With ETCS ON or ETCS OF displayed (Figure 19-4), momentarily press the S1, S2, S3, or S4 switch up or down. Display will toggle between the two operational states.
 - b. With ETCS ON or ETCS OF displayed, momentarily press the SEL A/SEL B switch to SEL A; display indicates FMCODES.
- 4. With current Mode 1 code displayed (Figure 19-3), verify Mode 1 code is properly set. Display shows the Mode 1 code in the form M1 AB00, where AB00 is the code, A is the most significant number of the code, and B is the least significant number; the two right-most digits are both set to 0. If the Mode 1 code needs to be modified, perform the following:
 - a. With M1 AB00 displayed, press the S1 switch up to increase or down to decrease the first number (most significant number) of the code.
 - b. With M1 AB00 displayed, press the S2 switch up to increase or down to decrease the second number (least significant number) of the code.
 - c. With desired Mode 1 code displayed, momentarily set the SEL A/SEL B switch to SEL A; display will indicate current operational status of E-TCAS.

Note

E-TCAS is disabled automatically when Mode S is disabled. To enable Mode S, perform paragraph 19.4.2, step 4.

5. With the display indicating FMCODES, Formation Member (FM) codes may be reviewed, modified, added, or deleted as described below:

Note

- When Mode S is disabled, FM codes cannot be modified. To enable Mode S, perform paragraph 19.4.2, step 4.
- E-TCAS operation requires entry of FM codes (Mode 3/A codes) of the member aircraft flying in formation. Up to 30 FM codes can be stored by the control panel. FM codes are numbered sequentially in memory from 01 through 30.
- a. To review FM codes, perform the following:
 - (1) With the display indicating FMCODES, momentarily press the S1, S2, S3 or S4 switch (up or down) to display first FM code location.
 - (2) Repeatedly press the SEL A/SEL B switch to SEL B to scroll through FM code locations.

Note

If an FM code has been entered, a sequence number and a corresponding Mode 3/A code are displayed. If an FM code has not been entered, a sequence number and a blank FM code are displayed (#nn) (Figure 19-8). An entered FM code appears in the form #nn ABCD, where nn is the Formation Member list number (01 – 30) and ABCD is 1 of 4096 possible Mode 3/A codes.

- (3) Upon completion of code review, press the SEL A/SEL B switch to SEL A to exit the review mode and go to next menu selection.
- b. To modify FM codes, perform the following:
 - (1) Hold the SEL A/SEL B switch to SEL A until FMCODES is displayed.

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- (2) With the display indicating FMCODES, momentarily press the S1, S2, S3 or S4 switch (up or down) to display first FM code. Repeatedly press the SEL A/SEL B switch to SEL B to scroll to desired FM code.
- (3) Press the S4 up or down until number to be changed has an asterisk (*) displayed.
- (4) Press the S3 up or down. FM code field will increase or decrease.
- (5) Press the SEL A/SEL B switch to SEL B to scroll through FM codes. Repeat Steps (c) and (d) to modify any other FM codes.
- (6) Upon completion of code modification, press the SEL A/SEL B switch to SEL A to exit the modification mode and go to next menu selection.
- c. To add FM codes, perform the following:
 - (1) Hold the SEL A/SEL B switch to SEL A until FMCODES is displayed.
 - (2) With the display indicating FMCODES, momentarily press the S1, S2, S3 or S4 switch (up or down) to display first FM code.
 - (3) Repeatedly press SEL the A/SEL B switch to SEL B until a sequence number and a blank FM code are displayed (#nn) (Figure 19-8).
 - (4) Press the S1 switch up. The FM code will change to add (Ann) (Figure 19-9).
 - (5) Press the S2 switch up or down to confirm addition. The Code field will be displayed (#nn 0000) (Figure 19-10).
 - (6) Press the S4 switch up or down until an asterisk (*) is displayed in the selected FM code number position.
 - (7) Press the S3 switch up to increase and down to decrease number at selected position.
 - (8) Press the SEL A/SEL B switch to SEL B to scroll to next available sequence number.
 - (9) Repeat Steps (4) through (8) to create additional FM codes.
 - (10) Upon completion of code addition, press the SEL A/SEL B switch to SEL A to exit the addition mode and go to next menu selection.
- d. To delete the FM codes, perform the following:

Note

When an FM code is deleted, all other FM codes following the deleted code will have their sequence number decreased by one. For example, if #04 4444 and #05 5555 were stored and #04 is deleted, the sequence number #04 would have #04 5555 displayed.

- (1) Hold the SEL A/SEL B switch to SEL A until FMCODES is displayed.
- (2) With the display indicating FMCODES, momentarily press the S1, S2, S3 or S4 switch (up or down) to display first FM code. Repeatedly press SEL A/SEL B switch to SEL B to scroll to desired FM code (#nn ABCD).
- (3) Press the S1 switch down. FM code will change to delete (Dnn ABCD) (Figure 19-11).

Note

If a code is selected for deletion that should not be deleted, press the SEL A/SEL B switch to SEL B. Display will scroll to the next FM code.

(4) Press the S2 switch up or down to confirm deletion. The display will be updated with the FM code from the next sequence number.

- (5) Repeatedly press the SEL A/SEL B switch to SEL B to scroll through FM codes. Repeat Steps (3) and (4) to delete any other FM codes.
- (6) Upon completion of code deletion, press the SEL A/SEL B switch to SEL A to exit deletion mode and go to next menu selection.
- e. To establish Formation Member status air traffic control on (ATC ON) or air traffic control off (ATC OF) perform the following:

Note

- When Mode S is disabled, Formation Member status cannot be modified. To enable Mode S, perform paragraph 19.4.2, step 4.
- When E-TCAS is disabled, the transponder and E-TCAS system will operate as a normal TCAS system which generates appropriate advisories based on the position of the MASTER switch (TA or TA/RA) and the proximity of other aircraft. When E-TCAS is enabled, the control panel must have aircraft Formation Member status defined. Aircraft that are defined as leader (ATC ON) will receive traffic and resolution advisories from the TCAS processor. Aircraft that are defined as Formation Member (ATC OF) will receive traffic advisories only from the TCAS processor and will not respond to Mode 3/A, Mode C, Mode S All-Call, and Mode S UF11 interrogations.
- (1) Hold the SEL A/SEL B to SEL A until ATC ON or ATC OF is displayed.
- (2) With ATC ON or ATC OF displayed (Figure 19-12), momentarily press the S1, S2, S3 or S4 switch up or down. The display will toggle between the two operational states.
- (3) With ATC ON or ATC OF displayed, momentarily press the SEL A/SEL B switch to SEL A; display will indicate current status of TCAS Broadcast mode (BCST).
- f. With the display indicating current Broadcast status (BCST ON or BCST OF (OFF)), change operational state as follows:
 - (1) With BCST ON or BCST OF displayed (Figure 19-13), momentarily press the S1, S2, S3 or S4 switch up or down. The display will toggle between the two operational states.
 - (2) With BCST ON or BCST OF displayed, momentarily press the SEL A/SEL B switch to SEL A; display scrolls back to Mode 3/A display.

19.4.2 Maintenance Menu (SEL B) Selections

- 1. The transponder defines the range of operation for the TCAS processor in nautical miles. To modify the range, perform the following:
 - a. Hold the SEL A/SEL B switch to SEL B until RNG (XX) is displayed.
 - b. With RNG (XX) displayed (Figure 19-14), press the S1, S2, S3 or S4 switch up to increase range or down to decrease range. (Display wraps around, i.e., increases past range 40 to 3).
 - c. Once the desired range is displayed, momentarily press the SEL A/SEL B switch to SEL B; display scrolls to current Display Brightness setting.
- 2. With the display indicating current brightness level (DISP XX), modify display as follows:
 - a. With DISP (XX) displayed (Figure 19-15), press the S1, S2, S3, or S4 switch up to increase display intensity or down to decrease display intensity.

Note

To set display for night vision operation, set display intensity to 0.1 or 0.05.

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- b. Once the desired intensity is displayed, momentarily set the SEL A/SEL B switch to SEL B; display scrolls to current Mode 2 code selection.
- 3. With the current Mode 2 code displayed (Figure 19-16), verify Mode 2 code is properly set. The display shows the Mode 2 code in the form M2 ABCD, where ABCD is the code, A is the most significant number of the code, and D is the least significant number. If the Mode 2 code needs to be modified, perform the following:
 - a. With M2 ABCD displayed, press the S1 switch up to increase or down to decrease the first number (most significant number) of the code.
 - b. With M2 ABCD displayed, press the S2 switch up to increase or down to decrease the next number of the code.
 - c. With M2 ABCD displayed, press the S3 switch up to increase or down to decrease the next number of the code.
 - d. With M2 ABCD displayed, press the S4 switch up to increase or down to decrease the last number (least significant number) of the code.
 - e. With the desired Mode 2 code displayed, momentarily press the SEL A/SEL B switch to SEL B to go to next menu selection.
- 4. Mode S is enabled upon initial power-on condition. If it is desired to disable or re-enable Mode S operations, perform the following:
 - a. Hold the SEL A/SEL B switch to SEL B until MODE S is momentarily displayed (Figure 19-17), then ENABLE (or DISABLE) is displayed.
 - b. With ENABLE (or DISABLE) displayed (Figure 19-17 momentarily press the S1, S2, S3 or S4 switch (up or down) to toggle between the operational states.
 - c. Momentarily press the SEL A/SEL B switch to SEL B to go to the next menu selection.
- 5. To verify the Mode S address (MS ADDR), perform the following:
 - a. Hold the SEL A/SEL B switch to SEL B until MS ADDR is momentarily displayed (Figure 19-18), then current Mode S address is displayed (Figure 19-19).
 - b. Verify the current Mode S address is properly set. If the Mode S address needs to be modified, perform the following:
 - (1) With the current Mode S address displayed, press the S4 switch to move asterisk to the right or press S1 switch to move asterisk to the left (Figure 19-20).
 - (2) Momentarily press the S2 or S3 switch up to increase characters or down to decrease characters (Figure 19-21). Holding the S2 or S3 switch in the up or down position will enable continuous increase/decrease.
 - c. Once the desired Mode S information is displayed, momentarily press the SEL A/SEL B switch to SEL B to go to next menu selection.
- 6. To verify the Mode S flight identification (MS FltID), enable Mode S as described in Step 4. above, then perform the following:

Note

When Mode S is disabled, Mode S flight identification cannot be modified. To enable Mode S, perform paragraph 19.4.2, step 4.

a. Hold the SEL A/SEL B switch to SEL B until MS FltID is momentarily displayed (Figure 19-23), then current flight identification code is displayed (Figure 19-24).

- b. Verify Mode S flight identification is properly set. If the Mode S flight identification code needs to be modified, perform the following:
 - (1) With the current Mode S flight identification displayed (Figure 19-25), press the S4 switch to move asterisk to the right or press the S1 switch to move asterisk to the left (Figure 19-25).
 - (2) Momentarily press the S2 or S3 switch up to increase characters or down to decrease characters (Figure 19-25). Holding the S2 or S3 switch in up or down position will enable continuous increase/decrease.
- c. Once the desired Mode S flight identification is displayed, momentarily press the SEL A/SEL B switch to SEL B to go to next menu selection.

Note

Mode S maximum air speed (is not normally displayed) inputs are normally pre-wired into the control panel. If the control panel does not have these inputs pre-wired, the display will provide the operator-entered values.

7. To modify transponder type, perform the following:

Note

If RT TYPE RT-1157 is selected, the control panel will not control the transponder.

- a. Hold the SEL A/SEL B switch to SEL B until RT TYPE is momentarily displayed (Figure 19-26), then RT-1717 is displayed.
- b. With RT-1717 displayed (Figure 19-27), momentarily press the S1, S2, S3, or S4 switch to change transponder type.
- c. Once the desired transponder type is displayed, momentarily press the SEL A/SEL B switch to SEL B to go to next menu selection.
- 8. To enable or disable antenna test (ANT TEST), perform the following:

Note

- ANT TEST should be disabled for most operational configurations.
- If ANT TEST is enabled, Mode S and TCAS are disabled until ANT TEST is disabled. Antenna test enables the separate testing of the top or bottom antenna.
- When ANT TEST is enabled and MASTER switch is set to NORM (or to TA or TA/RA), ANT TEST is displayed every 15 seconds.
- a. Hold the SEL A/SEL B switch to SEL B until ANT TEST is momentarily displayed (Figure 19-28), then ENABLE or DISABLE is displayed (Figure 19-29).
- b. With ENABLE displayed, momentarily press the S1, S2, S3, or S4 switch (up or down) to change operational state to DISABLE.
- c. Once DISABLE is displayed, momentarily set the SEL A/SEL B switch to SEL B to go to next menu selection.
- 9. To enable control panel test (CP TEST), perform the following:

Note

Once CP TEST is started, the control panel self-test will run automatically. Self-test is completed when SW TEST is displayed. To exit CP TEST, hold SEL A/SEL B switch to SEL A or set MASTER switch to NORM (or to TA or TA/RA).

- a. Hold the SEL A/SEL B switch to SEL B until CP TEST is displayed (Figure 19-30).
- b. When CP TEST is displayed, momentarily press the S1, S2, S3, or S4 switch (up or down). The display will indicate BIT messages (Figures 19-31, 19-32, 19-33, and 19-34).
- c. When SW TEST is displayed (Figure 19-35), the control panel switches can be tested.
- d. When SW TEST is displayed, hold the SEL A/SEL B switch to SEL A or SEL B for approximately two seconds to terminate interactive switch test.
- 10. Press on the M4 REPLY indicator to test for proper illumination. Rotate indicator to achieve desired illumination (counter-clockwise brightens indicator).



To prevent damage to the switch, pull outward on MASTER switch knob before turning the switch from STBY to OFF, and before turning it from TA/RA to EMER. Release the knob after the new position (OFF or EMER) is selected.

11. Set MASTER switch to NORM, TA, or TA/RA position.

19.4.3 Operating Procedure

Completion of the pre-operating procedure leaves the transponder in operating condition. The following additional steps may be required, depending upon mission instructions:



If current Mode 4 codes are not loaded, set MODE 4 TEST/ON/OUT switch to OUT and AUDIO/LIGHT/OUT switch to OUT.

1. If Mode 4 code A has expired, set the MODE 4 CODE rotary switch to B.

Note

Step 2. is true only if aircraft landing gear has cycled (down-up-down). If MODE 4 CODE HOLD is selected, code can only be zeroized by pressing ZEROIZE on Crypto Applique or Mode 4 Computer, or by performing Step 3.

- 2. If code retention in the crypto applique or Mode 4 computer is desired during ground aircraft refueling, set the MODE 4 CODE switch to HOLD and then release it. Wait 15 seconds before setting the MASTER switch to OFF. Perform Step 4.
- 3. If code retention is not desired, set the MODE 4 CODE rotary switch to ZERO to clear Mode 4 code held in crypto applique or Mode 4 computer.
- 4. Set any of the M-1, M-2, M-3/A, M-C or MODE 4 switches to OUT in order to inhibit transmission of replies in the undesired modes.

- 5. Set the IDENT/OUT/MIC switch momentarily to IDENT in order to transmit Special Position Identification (SPI) pulses. Setting this switch to MIC transmits SPI pulses only when the microphone press-to-talk key is down (SPI pulses will be enabled for a 15 to 30-second period when activated).
- 6. To enable the RAD TEST switch, hold the switch to RAD TEST position. When the RAD TEST switch is enabled and interrogated in Mode 4, the transponder will reply with a "Verify Bit 1" set. Also, when RAD TEST switch is momentarily enabled (pressed up), the transponder will override the on-the-ground reply inhibit to Mode 3/A, Mode C, ATCRBS/Mode S All-Call, and Mode S only All-Call interrogations. Each time the RAD TEST switch is momentarily pressed up, the transponder will override the on-the ground reply inhibit for 1 minute (up to 5 minutes total).



To prevent damage to the switch, pull outward on MASTER switch knob before turning the switch from STBY to OFF, and before turning it from TA/RA to EMER. Release the knob after the new position (OFF or EMER) is selected.

19.4.4 Stopping Procedure

To stop the transponder set, pull out and rotate the MASTER switch to OFF.

Note

If landing gear has cycled (up and down), automatic zeroizing of the Crypto Applique or Mode 4 Computer codes will occur, unless codes are retained as described in paragraph 19.4.3, Step 2.

PART VIII

Mission Systems

Chapter 20 — Aircraft Survivability Equipment

CHAPTER 20

Aircraft Survivability Equipment

20.1 INTRODUCTION

This chapter provides information on aircraft survivability equipment (ASE). The UC-12W is equipped with an AN/ALE-47 Countermeasures Dispensing Set (CMDS) and is fully integrated with an AN/AAR-47 Missile Warning System (MWS) to provide a defense against ground launched missile threats. An ASE system block diagram is depicted in Figure 20-1. For additional information not found in this chapter, refer to A1-C12WA-NFM-010, NATOPS Flight Manual Aircraft Survivability Supplement located in the NATOPS Product Library on the Airworthiness classified (SIPRNET) website at https://airworthiness.navair.navy.smil.mil.

20.2 AN/ALE-47(V) COUNTERMEASURES DISPENSING SET (CMDS)

The AN/ALE-47(V) CMDS is an integrated, reprogrammable, computer controlled aircraft defense system designed to provide protection against hostile radar and infrared threats through the use of expendable decoys. The AN/ALE-47(V) system enhances aircraft survivability in sophisticated threat environments. The system is designed to provide the capability of automatic or pilot commanded response, and works alone or in coordination with other countermeasures defense systems by processing inputs from on-board electronic warfare (EW) sensors, selecting, and dispensing the appropriate response to defeat air interceptor (AI), anti-aircraft artillery (AAA), and surface-to-air missiles (SAMs).

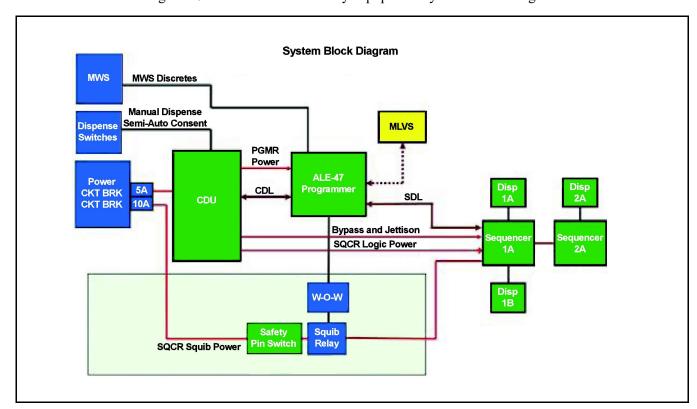


Figure 20-1. Aircraft Survivability Equipment System Block Diagram

A1-C12WA-NFM-000

20.2.1 AN/ALE-47(V) Countermeasures Dispensing Set (CMDS) Description and Components

The CMDS consists of a control display unit (CDU), programmer, sequencers, dispenser assemblies, and safety devices. The system is powered by 28 Vdc from the auxiliary circuit breaker panel located on the passenger compartment avionics rack. The passenger compartment avionics rack is depicted in Figure 20-2.

20.2.1.1 Control Display Unit (CDU)

The CDU is located in the cockpit extended pedestal, as depicted in Figure 20-3, and it is the primary source of interface between the operator and the CMDS. The CDU electrically interfaces with cockpit dispense switches, cockpit lighting controls, aircraft/ground power, programmer, and sequencer; it provides the operator with the ability to input control and dispense commands as well as receive operational status from the CMDS. The CDU displays operator prompts at power up; a list of operator prompts is depicted in Figure 20-4. CDU controls and displays with associated functions are depicted in Figure 20-5.

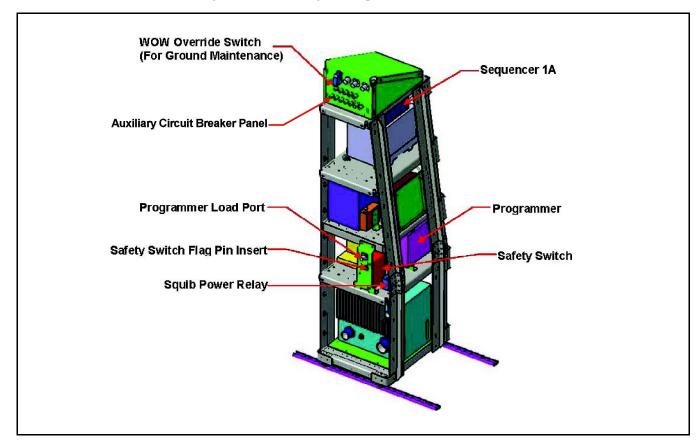


Figure 20-2. Passenger Compartment Avionics Rack

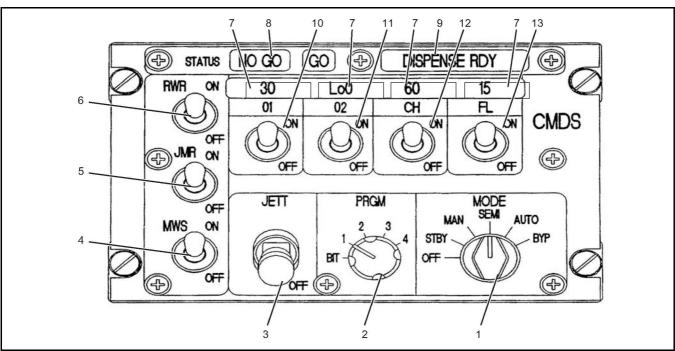
Figure 20-3. Control Display Unit (CDU) Location



Figure 20-4. Control Display Unit (CDU) Operator Prompts

PROMPT DISPLAYED	RESULTS WHEN SELECTED
?RPT MAG IDS	Sequencer Address with Magazine IDs
?TURN ON FTI / ?TURN OFF FTI	Turns Flight Test Instrumentation On/Off
?TURN ON TRN / ?TURN OFF TRN	Turns Training On/Off

Figure 20-5. Control Display Unit (CDU) Controls and Displays



Index	Control/Indicator	Function		
1	MODE Switch	Six-position rotary switch that enables the flight crew to select the operating mode for the Countermeasures Dispensing System (CMDS).		
	Note			
	The dispense functions in the MAN, SEMI, and AUTO modes will not operate unless all of the following conditions are met:			

- 1. The CMDS safety pin is removed.
- The Weight On Wheels (WOW) relay is closed (weight is off the wheels).
- The enable switch for the selected category to be dispensed is ON.
- The FLARE PWR circuit breaker is closed.
- 1. Removes +28 VDC power from the CMDS. All functions are disabled except JETTISON. 1. OFF 2. STBY (Standby) 2. Applies +28 VDC power to CMDS. Initiates Power-up BIT
 - (PBIT), generates stores inventory for display on CDU, and permits software loading. Dispenser program selection is disabled. The only dispensing function is JETTISON.

CAUTION When the CMDS is in the MAN (Manual) mode, automatic responses to MWS-detected

threats are not available. Note

In order for any stores inventory to be displayed on the CDU, at least one stores magazine assembly or one Improved Flight Line Payload Simulator (IFLPS) must be installed.

Figure 20-5. Control Display Unit (CDU) Controls and Displays (cont.)

lua el e co	Combinal/II	F	
Index	Control/Indicator	Function	
1 (Cont.)	3. MAN (Manual)	 Applies +28 VDC power to CMDS. Makes predetermined dispense programs 1 through 6 available to operator. The dispense programs are alterable by use of the Memory-Loader/Verifier Set (MLVS). 	
	4. SEMI (Semi-Automatic)	4. Applies +28 VDC power to CMDS. When MWS switch is ON, uses threat information provided by the MWS to generate and activate the dispense command with operator consent. At any time, the operator can dispense stores as selected from one of the manual programs.	
	5. AUTO	5. Applies +28 VDC power to CMDS. When MWS switch is ON, uses threat information provided by the MWS to generate and immediately activate the dispense command without operator consent. At any time, the operator can dispense stores as selected from one of the manual programs.	
	6. BYP	6. Selected by rotating the MODE switch to AUTO, pressing the switch, and rotating it clockwise. In the event of a critical failure of the CDU or Programmer, the CMDS provides a Bypass Dispense Program directly from the sequencer. When this program is selected, only Bypass and Jettison Modes are available. All displays, annunciators, and indicators on the CDU are extinguished.	
2	PRGM (Program) Switch	Five-position rotary switch which selects the preset operating program for the system. The BIT position is spring-loaded so that this position is momentary.	
	1. BIT	Starts the CMDS Initiated Built-In Test (IBIT) when the MODE switch is set to any position except OFF and BYP. Also used to respond to questions presented on the CDU display.	
	2. 1	2. Selects manual program 1.	
	3. 2	3. Selects manual program 2.	
	4. 3	4. Selects manual program 3.	
	5. 4	5. Selects manual program 4.	
3	JETT (Jettison) Switch	Two-position toggle switch with mechanical interlock (pull to unlock) to prevent inadvertent operation. Enables the flight crew to jettison all remaining expendables at once.	
	Note		
	The jettison function will not	operate if one or more of the following conditions is met:	
	 The CMDS safety pin is fully engaged. The aircraft has weight on wheels (WOW switch engaged). 		
	3. The Mission Power switch is OFF.		
	4. The FLARE PWR circui		
	1. JETT	 Causes the system to override selected mode and rapidly dispense all remaining FL, O1, and O2 inventory, regardless of the selected position of the MODE switch. Normally used only in aircraft emergencies. 	
	2. OFF	2. Inhibits the jettison function.	

Figure 20-5. Control Display Unit (CDU) Controls and Displays (cont.)

Index	Control/Indicator	Function		
CMDS Sensor Enable Switches				
4	MWS Switch	Two-position toggle switch to enable or inhibit automatic or semi-automatic payload dispensing inputs from the Missile Warning System (MWS).		
	1. ON	1. Enables MWS inputs.		
	2. OFF	Inhibits MWS inputs. MWS programs are not available when the MWS switch is in this position.		
5	JMR Switch	Not used in this system.		
6	RWR Switch	Not used in this system.		
7	Digital Display	Illuminates on power up. Sixteen alphanumeric characters, four above each stores category, display payload inventories, low payload quantity, BIT messages and failure codes, pilot's PFL and MFL and digital control display unit maintenance mode.		
	1. Lo(x)	Indicates the inventory of the stores category associated with the display has decreased to the Low threshold number (x) preset in software.		
	2. Any numerical value	Indicates the quantity inventoried for the stores category associated with the display.		
		STATUS Indicators		
8	NO GO/GO Indicator	The yellow NO GO indicator illuminates to indicate the BIT has detected a critical system failure, preventing normal operation.		
		The green GO indicator illuminates to indicate the system is operational for all functions.		
9	DISPENSE RDY Indicator	The green DISPENSE RDY indicator is not used in this installation.		
	CN	IDS Category Enable Switches		
10	O1 Switch	Two-position toggle switch to enable or inhibit Category O1 (Other 1).		
	1. ON	Enables dispensing category O1 stores.		
	2. OFF	2. Inhibits dispensing category O1 stores.		
11	O2 Switch	Two-position toggle switch to enable or inhibit Category O2 (Other 2).		
	1. ON	Enables dispensing category O2 stores.		
	2. OFF	2. Inhibits dispensing category O2 stores.		
12	CH Switch	Two-position toggle switch to enable or inhibit Category CH (Chaff).		
	1. ON	Enables dispensing category CH stores.		
	2. OFF	2. Inhibits dispensing category CH stores.		
13	FL Switch	Two-position toggle switch to enable or inhibit Category FL (Flare).		
	1. ON	Enables dispensing category FL stores.		
	2. OFF	Inhibits dispensing category FL stores.		

20.2.1.2 Programmer

The programmer, depicted in Figure 20-6, is the central processing unit (CPU) for the CMDS and is fully integrated with the AN/AAR-47 MWS. Signals from the MWS Computer Processor are sent to the CMDS Programmer via four discrete lines. When an incoming infrared (IR) missile or laser threat is detected, the MWS Computer Processor warns aircrew through audio and/or visual warnings and sends a dispense request to the CMDS programmer. The programmer also communicates with the CDU and sequencers. The CDU communications include control settings, manual dispense commands and system status. Sequencer communications include power up, bypass, jettison programming, inventory status, sequencer and dispenser status, and dispense commands. All built-in-test (BIT) functions are performed by the programmer and displayed via the CDU. All BIT results are recorded in memory for later recovery. System control regulates the activities of the CMDS and is performed by the programmer during normal operation and by the sequencer when BYP mode has been selected. The system control functions performed by the programmer are monitoring and/or controlling all communications within the CMDS. Included are the cockpit data link (CDL) and the sequencer data link (SDL), managing all mode changes within the system. It ensures that all system elements operate correctly with the cockpit selected mode. Automatic configuration accepts data from the MDF and other equipment in the CMDS to configure the system to the aircraft. If inconsistencies are identified, they are sent to the BIT processing. Programmer timing parameters are depicted in Figure 20-7.

Note

The programmer must be handled as CONFIDENTIAL at all times to protect program software contents in the MDF.

20.2.1.3 Sequencer

The sequencer, depicted in Figure 20-8, determines magazine payload configuration and monitors inventory levels in each dispenser. Each sequencer installed is given a unique address setting that allows the programmer to communicate with that specific sequencer. The current configuration UC-12W has two sequencers installed. The sequencer generates squib firing power to specific payload locations in the interfaced dispenser assembly, conducts BIT, determines magazine identification, routes fire pulses to payload locations, and monitors inventory. If the programmer or CDU fails, the sequencer can be operated manually when the CDU MODE switch is placed in the BYP position. The sequencer has two address switches (S1 and S2) which are manually set by maintenance personnel when the sequencer is installed. The Sequencer that controls the left and right dispensers is address 1A and the Sequencer that controls the forward dispenser is address 2A.

If both sequencers are set to the wrong address, the control display unit NOGO annunciator will illuminate and will display PROG FAIL CHK BYP indicating no sequencer is reporting status. If the address switches are set correctly, the inventory will be displayed on the CDU. The sequencer operates with the operational flight program (OFP).



Figure 20-6. Programmer

Figure 20-7. Program Parameters

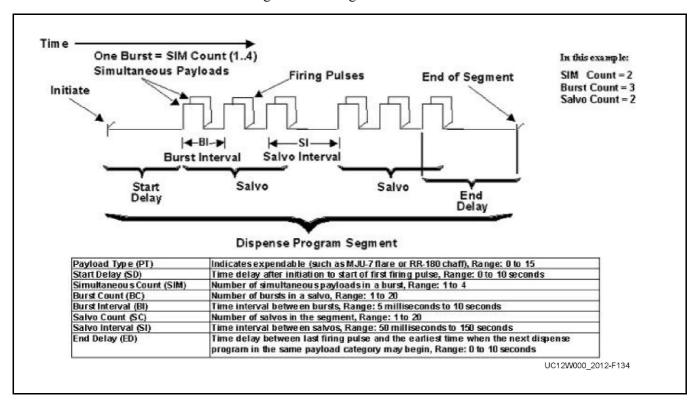


Figure 20-8. Sequencer



20.2.1.3.1 Squib Firing

The sequencer switch generates, routes, and transmits squib firing current to each location in the interfaced dispenser assembly. Four independently controlled fire sources interface with one magazine for initiation of squib firing. The sequencer generates and routes up to 5.75 amps for the fire pulse duration programmed in the MDF when commanded to fire; duration is set to 20 msec in MDF 2763 and later. The sequencer is able to initiate fire pulses to the same dispenser assembly simultaneously as doubles and triples with the total error no greater than 5 msec. A fourth expendable is also able to be initiated within 10 msec of the initiation of the first of the triple to the same dispenser assembly.

a. Explicit Dispensing

Dispensing of expendable payloads is the result of an explicit dispense command only. The sequencer does not inadvertently or accidentally cause dispensing of payloads.

b. Dispense Inputs

In normal operational mode, dispense commands are received via the SDL. In the Bypass mode, dispense commands are routed directly to the sequencer via a discrete signal from the manual dispense switches.

c. SDL/Jettison

A valid jettison command consists of an SDL command or a jettison discrete signal when in the bypass mode. The jettison command is automatically repeated a second time for safety. The UC-12W Jettison program will take approximately 22 seconds to complete.

d. Minimum Fire Source Rest Time

The fire source rest time is the interval between trailing edge of the fire pulse and the leading edge of the next fire pulse signal for an individual fire source. The minimum rest time is equal to the fire pulse duration; the fire pulse duration is programmable via the MDF and is set to 20 msec in MDF 2763 and later.

20.2.1.3.2 Magazine Identification (MAG ID)

The sequencer receives discrete MAG ID inputs from the interfaced dispenser assemblies that uniquely identify the payload mix in each magazine. One of 16 unique magazine loadouts is input to the sequencer firmware.

20.2.1.3.3 Magazine Present

The sequencer receives a discrete from the dispenser assembly indicating that a magazine is installed.

20.2.1.3.4 Built In Test (BIT)

The sequencer provides the BIT circuitry for operational readiness determination and organizational maintenance.

20.2.1.3.5 Polling

The sequencer generates and routes polling pulses for use in inventory determination. Polling for inventory determination of the interfaced dispenser assembly requires approximately one second. A single polling pulse does not exceed 350 mA for a maximum of 52 microseconds. The sequencer polls in the absence of squib power. The polling pulse is used to determine payload squib continuity in the dispenser assembly. Non-volatile memory is provided to store inventory of Navy squibs. Inventory polling occurs every five minutes.

20.2.1.3.6 Misfire Detection and Correction

The misfire detection and correction function provides misfire detection and correction for all payloads. A misfire is an attempt and the subsequent failure to fire a squib, even if the squib appeared good during system power-up polling and reporting. Misfire correction is the application of firing power to an alternate payload. Upon misfire detection, the misfire detection and correction function accomplishes correction within five milliseconds for all payloads.

20.2.1.3.7 SDL/Bypass Discrete Interface

The sequencer provides two physical and electrical discrete interfaces for use in the bypass mode operation. The bypass discrete provides an indication to the sequencer firmware that bypass mode has been selected. When Bypass mode has been selected, activation of the up position of the pilot/copilot four position dispense switch or the pilot/copilot slap switches causes a dispense of expendable quantities designated in the MDF that are loaded in the dispenser magazines. The jettison discrete signal provides an indication to the sequencer firmware to initiate a jettison if in the bypass mode. Discrete signals are 28 Vdc.

20.2.1.3.8 Fire Current Monitor

The sequencer provides monitoring of squib firing currents. Current is monitored for all fire events and indication provided to the sequencer firmware when current has exceeded 2.0 ± 0.50 amps. The indication is used to determine if a misfire has occurred.

20.2.1.4 Dispenser Assembly

The dispenser assembly, depicted in Figure 20-9, consists of a dispenser housing and magazine assembly that provides electrical interface between the sequencer and squibs (impulse cartridges) for routing fire signals that eject the countermeasures.

20.2.1.4.1 Dispenser Housing

The dispenser housing provides the capability to carry and identify magazines, absorption of forces into the aircraft structure, and provides firing signals to stores in loaded magazines. The dispenser housing electrically and mechanically interfaces with and supports the magazine.

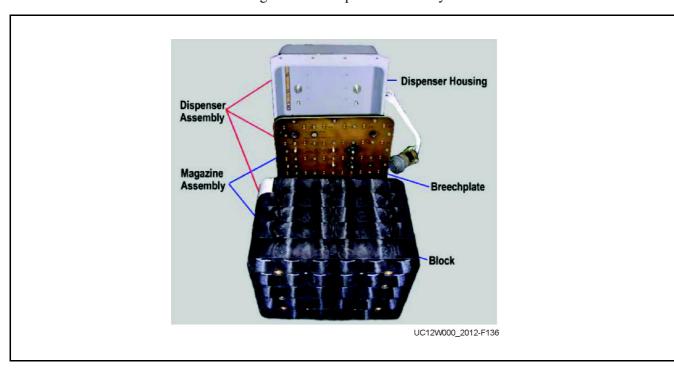


Figure 20-9. Dispenser Assembly

20.2.1.4.2 Magazine Assembly

The MX-12023/ALE-47(V) magazine assembly is designed to carry 30 of the 1.42 inch diameter cartridges such as MJU-32s and MJU-49s. The magazine consists of a block with receptacles for the expendable cartridges and a breechplate with its associated MAG ID. The breechplate routes a firing signal to the designated impulse cartridge.

The breechplate also reports the magazine load configuration via two four-position switches mounted on the breechplate. One switch is labeled A, B, C, D the other is labeled 1, 2, 3, 4. The MDF relies on the correct setting of these switches to determine magazine load configuration.

20.2.1.5 Safety Devices

The ALE-47(V) is equipped with a safety switch and a weight-on-wheels (WOW) bypass switch.

20.2.1.5.1 Safety Switch

The safety switch, as depicted in Figure 20-10, is located in the passenger compartment avionics rack. It is designed to prevent squib power from reaching the sequencer. By inserting the safety pin into the safety switch the sequencer is isolated, preventing the countermeasures dispenser system from launching flares.

20.2.1.5.2 Weight-On-Wheels (WOW) Bypass Switch

The WOW bypass switch is located in the passenger compartment avionics rack. It is an added safety feature that works with the safety switch and landing gear's WOW switch to prevent launching flares while the aircraft is on the ground. Since the safety switch and landing gear's WOW switch can be bypassed, the WOW bypass switch is placed to the NORM position. In the NORM position, the switch removes electrical power to the flare relay causing it to open. This action prevents electrical power from reaching the sequencer while the aircraft is on the ground. If electrical power is needed by the sequencer for ground maintenance activities, the WOW bypass switch must be positioned to the BYPASS position. In the BYPASS position, electrical power is provided to the flare relay, causing it to close. When maintenance activities are complete, the WOW bypass switch must be positioned to the NORM position.



Figure 20-10. Safety Switch

20.2.2 AN/ALE-47(V) Countermeasures Dispensing Set (CMDS) Operation

The AN/ALE-47(V) CMDS operates in one of six primary modes: OFF (Off); STBY (Standby); MAN (Manual); SEMI (Semi-Automatic); AUTO (Automatic); or BYP (Bypass). The AN/ALE-47(V) provides a BIT function to accomplish system level fault detection and a system checkout mode that is used by maintenance personnel for system testing and troubleshooting, and release and control checks. The AN/ALE-47(V) also provides a training mode feature which allows pilots a safe training environment where expendables are not actually dispensed (except for jettison). Flight test instrumentation (FTI) is also available and provides the capability to collect internal threat processing and dispensing data.

20.2.2.1 OFF (Off)

The CMDS is de-energized upon selection of the OFF mode on the CDU with the exception that JETT (Jettison) overrides the OFF mode. If JETT is selected with the safety devices applied the system will power on but no dispensing will occur because squib power to the sequencer is interrupted.

20.2.2.2 STBY (Standby)

In the STBY mode, the CMDS is powered on and performs the power up built in test (PBIT), including stores inventory. In STBY mode, electrical power is not applied to any impulse cartridge except for inventory purposes and during jettison. JETT overrides the STBY mode, except when the safety devices are applied. Software is loaded in the STBY mode.

20.2.2.3 MAN (Manual)

When MAN is selected, Manual Programs 1, 2, 3, 4, 5, and 6 are available for dispensing. These are predetermined dispense patterns defined in the MDF. Automatic responses to MWS detected threats are not available in the MAN mode. Because of this limited functionality the MAN mode must be used with caution. Jettison overrides the MAN mode except when the Safety Switch pin is inserted or the WOW circuitry determines that the aircraft is on the ground.

20.2.2.4 SEMI (Semi-Automatic)

In the SEMI mode, the CMDS prepares a dispense program in response to threats detected by the MWS when the MWS sensor switch is in the ON position. In SEMI mode the AN/ALE-47(V) will automatically dispense when activated by the MWS and override any low stores limits. All six manual programs are available in the SEMI mode.

20.2.2.5 AUTO (Automatic)

In the AUTO mode, threat responses initiated by the MWS are automatically dispensed when the MWS sensor switch is in the ON position. All six Manual Programs are available in the AUTO mode.

20.2.2.6 Low Stores Limits

MDF 2763 and later is programmed with a Low Stores limit (minimum remaining inventory) value of Zero (0) for Chaff, Six (6) for Flare, Two (2) for Other 1, and Eight (8) for Other 2. There will be a Lo message which will appear in the inventory display next to each affected inventory on the CDU.

20.2.2.7 BYP (Bypass)

In the event of a critical failure of the CDU or Programmer, the CMDS provides a BYP mode that is used to bypass the programmer and command dispense directly from the sequencer. BYP is selected by rotating the MODE switch fully clockwise and pressing in on the switch to enter the BYP position. When BYP is selected, all displays, annunciators, and indicators on the CDU are extinguished.

20.2.2.8 Built In Test (BIT)

The AN/ALE-47(V) CMDS provides a BIT function to accomplish system level fault detection and isolation to the weapons replaceable assembly (WRA). The BIT capability includes the following functions: CDU; sequencing; dispensing; programming functions. The distributed BIT functions perform in concert with each other under control of the programmer. Failure indications are provided to the operator via the CDU display. BIT does not rely on the presence or absence of interfacing equipment except for initiation and reporting. Faults detected by the BIT function are maintained such that they can be formatted into a pilot's fault list (PFL) and a maintenance fault list (MFL). The PFL contains only information that the operator would need immediately prior to or during flight to determine status of the CMDS. The PFL includes, but is not limited to, indication of the MDF and OFP versions installed. The MFL contains all information included in the PFL as well as the remaining detailed fault information to be used by maintenance personnel. BIT coverage during BYP mode of operation is limited to the sequencers due to power interruption to the programmer and CDU. When the system is in BYP Mode, sequencer BIT reporting cannot occur because the programmer and CDU are disabled.

20.2.2.8.1 Power Up BIT (PBIT)

The AN/ALE-47(V) initiates PBIT upon power up. PBIT continues until there is a GO/NO GO determination. After an initial 5-7 second warm-up, PBIT performs the same as initiated BIT (IBIT), described below. When the AN/ALE-47(V) is set to an operational mode (MAN, SEMI, or AUTO) at power up, PBIT will be interrupted upon receipt of a dispense request and then will continue PBIT after dispensing.

20.2.2.8.2 Initiated BIT (IBIT)

The IBIT function is activated in response to selecting BIT on the CDU PRGM Switch. IBIT determines status and operability of the CMDS. It indicates system status and any present faults to the operator. IBIT also identifies and reports the versions of the MDF and OFP. When the AN/ALE-47(V) is set to an operational mode (MAN, SEMI, or AUTO), IBIT is interrupted upon receipt of a dispense request and continues IBIT after dispensing. IBIT includes additional functions not accomplished by continuous BIT (CBIT), described below. IBIT creates a complete system BIT composite.

20.2.2.8.3 Continuous BIT

The CBIT provides a constant check on CMDS operational status to the maximum extent possible in the selected mode of operation to determine any faults that prevent operation of the system. CBIT is performed on a non-interference basis only and is interrupted when a dispense request is initiated, but resumes where interrupted when the dispense program is completed. If degraded mode situations are detected (e.g., system operational in nothing but MAN mode), CBIT is used to check if the CMDS status changes. Sufficient indication is provided to the operator to allow a change to an alternate and/or newly operative mode. CBIT provides notice to the BIT control function of changes in operational status. CBIT passes current BIT status to the IBIT function upon receipt of an IBIT command.

20.2.2.9 System Checkout Mode

System checkout mode is used by maintenance personnel for system testing and troubleshooting, and release and control checks. When the system is placed in system checkout mode (via IBIT) an unclassified MDF automatically overwrites the operational MDF stored in RAM. Using system checkout mode allows maintenance actions across similar aircraft to be consistent and allows unclassified dispense quantities to be used in aircraft publications. When in system checkout mode an S is displayed in the far left side of the CDU. To exit system checkout mode, power off the system. Upon next power up, the operational MDF is again functional.

20.2.2.10 Training Mode

OFP 1129 and subsequent include a training mode feature, which provides pilots a safe training mode where expendables are not actually dispensed (except for jettison) and aircraft controls and displays act normally. This feature allows pilots to set and reset the training mode inventory in the air. In addition, magazines need not be loaded in dispensers for training mode. The training mode feature is enabled via an MDF variable and turned on or off via the CDU. Actual dispensing of expendables in training mode is only allowed upon selection of bypass or jettison mode. The magazine loadouts for training mode are composed of the full inventory of the currently loaded magazines or the default training magazine IDs as defined in the MDF. When in the training mode, a T appears in the leftmost position of the 16-character display on the CDU. During IBIT, the CMDS provides a training mode status indication on the CDU. The display reads FTI XXX TRN XXX where TRN XXX is either:

- 1. TRN N/A (if the training mode is disabled in MDF);
- 2. TRN OFF (if MDF enabled but off);
- 3. TRN ON (if MDF enabled and on).

Training mode default MAG ID data is depicted in Figure 20-11. Default magazine selection will occur if no magazines are loaded.

20.2.2.11 Flight Test Instrumentation (FTI)

Flight test instrumentation (FTI) provides the capability to collect internal threat processing and dispensing data for transmission to the EW bus or for storage in the programmer's memory. MDF 2763 and later is programmed for FTI to record to EEPROM and is defaulted to turn ON at power up. FTI recording will not interfere with ALE-47 dispense processing. The CMDS provides a status indication on the CDU during IBIT. The display reads "FTI XXX TRN XXX" where "FTI XXX" is either "FTI N/A" if disabled in MDF; "FTI OFF" if MDF enabled, but currently off; or "FTI ON" if MDF enabled and currently on.

20.2.2.12 System Checkout

- 1. On the CDU, place the MODE Switch in STBY.
- 2. Place the PRGM Switch in 1. Place the O1, O2, CH, FL Category Enable switches and the RWR, MWS, and JMR Source Inhibit switches in the OFF position.
- 3. On the CDU, momentarily place the PRGM Switch in the BIT Position. In the following steps, each CDU message is present for approximately 5 seconds.
- 4. To quickly advance to the next message, momentarily place the PRGM Switch in the BIT Position.
- 5. When a question is presented, answer NO by either waiting for the message to time out or by engaging the BIT position of the PRGM Switch.
 - a. To answer YES, move the PRGM switch from Position 1 to Position 2 and then back to Position 1.

System checkout CDU messages are depicted in Figure 20-12.

Figure 20-11. Default Training Mode Magazines

01	O2	СН	FL
Т 6	58		26

Figure 20-12. System Checkout CDU Messages

MESSAGE	MEANING	ACTION
OFP#1136MDF#2764 Software loaded in the Programmer.		
TRN XXX FTI ON	Status of Training Mode and FTI.	
?TURN ON TRN or ?TURN OFF TRN	Opportunity to turn TRN ON or OFF.	Answer NO.
?RPT MAG IDS	Prompt to user to identify Mag IDs	Answer NO.
?MAINTENANCE OP	Opportunity to enter Maintenance Mode.	Answer NO.
?RPT SQUIB DATA	Opportunity to review Squib Data.	Answer NO.
?SYSTEM CHECKOUT	Opportunity to enter System Checkout.	Move PRGM Switch on CDU from Position 1 to Position 2.
SYSTEM CHECKOUT	Indicated System Checkout is selected.	Move PRGM Switch on CDU from Position 2 to Position 1.
?RPT MAG IDS	Opportunity to view MAG ID Switch settings.	Answer YES. Refer to Paragraph 9.0.
MAG ID(s)	Confirmation that MAG ID reporting is selected.	

Figure 20-12. System Checkout CDU Messages (cont.)

MESSAGE	MEANING	ACTION
SQxx MAG y ID zz	Sequencers, Magazines, and MAG ID Switch settings are reported.	Repeats unit all MAG IDs are reported.
?RPT PRGM DISCRT	Opportunity to view the Programmer Discrete Inputs.	Move PRGM Switch on CDU from Position 1 to Position 2.
TOG/Set Discrete	Opportunity to Toggle/Set the Programmer Discrete Inputs.	Move PRGM Switch on CDU from Position 2 to Position 1.
PRGM DIS nn = b^	Discrete States are displayed where nn = Discrete Input Number b = Discrete Input State (0, 1) ^ indicates operator toggled the Discrete.	Display repeats until all Discretes are displayed.
?Non OP MDF Load	Opportunity to load the Non Operational System Checkout MDF 27E7/27E8.	Answer YES or NO as required. Assume YES. See below for NO.
NonOP MDF Load	Indicates the Non Operational System Checkout MDF 27E7/27E8 is loaded properly.	Move PRGM Switch on CDU from Position 1 to Position 2.
S ## ## ## ##	"S" indicates this inventory is reported by the Non OP MDF. "S" is displayed as long as system is in System Checkout.	Move PRGM Switch on CDU from Position 2 to Position 1.
?Non OP MDF Load	Opporttunity to load the Non Operational System Checkout MDF.	Answer NO.
Inventory	Indicates that the Non Operational System Checkout MDF is not loaded.	Display reverts to normal operation.

20.2.2.13 Magazine ID (MAG ID) Reporting at Power Up

MAG ID configurations can be displayed on the CDU during the power up sequence, during IBIT, and during system checkout. The MAG IDs reported are identified by a MAG ID number, not the MAG ID breechplate switch settings. See Figure A-2 for MAG ID number for each Magazine ID Switch Setting. During the MAG ID reporting sequence, the CDU displays messages as depicted in Figure 20-13.

Figure 20-13. Magazine ID (MAG ID) Reporting

MESSAGE MEANING		ACTION
?RPT MAG IDS	Prompt to user to identify Mag IDs.	Answer YES or NO as required (Assume YES).
		Move PRGM switch from Position 1 to Position 2.
Magazine ID(s)	Ready for display Mag IDs.	Move PRGM switch from Position 2 to Position 1.
SQ1A MAG A ID XX.	Sequencer Address 1A Magazine A is set to MAG ID XX.	Rotate the PRGM switch to the Bit position and release or wait for this display to complete.
SQ1A MAG B ID XX	Sequencer Address 1A Magazine B is set to MAG ID XX.	Rotate the PRGM switch to the Bit position and release or wait for this display to complete.
SQ2A MAG A ID XX	Sequencer Address 2A Magazine A is set to MAG ID XX.	Rotate the PRGM switch to the Bit position and release or wait for this display to complete.

20.2.2.14 Load Sequencer OFP Message on CDU

The CDU alerts personnel when there is an installed Sequencer with software version number that is lower than the MDF defined sequencer software version (Sequencer OFP 3052/3053) at power-up. The CDU will display message "LOAD SQCR OFP". To load Sequencer OFP 3052/3053, reference approved software loading procedure in "AN/ALE-47 User's Guide for UC-12W (Three Dispenser) Mission Data File 2764".

20.2.2.15 Squib Power Alert Message on CDU

The CDU alerts personnel when squib power is not available to at least one of the Sequencers at Power Up. "SQCR POWER LOSS" is present in the CDU display when Weight-On-Wheels is false (override or airborne) and mode is in STBY, MAN, SEMI, or AUTO.

Display Sequence:

OFP#1136MDF#2764

SQCR POWER LOSS (self cancels after 5 seconds)

?RPT MAG IDS (self cancels after 5 seconds)

FTI ON TRN OFF

?TURN OFF FTI

?TURN ON TRN

SEQ XX PWR LOSS (requires acknowledge i.e. rotating the PRGM switch to BIT position and release to clear, XX is the address of the Sequencer with squib power failure)

(Inventory)

If Squib Power Failure is detected at Power Up and Weight-On-Wheels is true (aircraft on ground) and if Weight-On-Wheels subsequently becomes false without resetting the power to the ALE-47 (aircraft becomes airborne), the SQCR POWER LOSS message is displayed. This message will be cancelled upon the system reestablishing Squib Power. The SQCR POWER LOSS message can be cancelled manually by resetting the power to the ALE-47 or by rotating the PRGM switch to BIT position and release on the CDU. If cancelling by selecting BIT on the CDU, the SEQ XX PWR LOSS message is subsequently displayed. The SEQ XX PWR LOSS message can also be cancelled manually by selecting BIT on the CDU.

When Squib Power is available to at least one of the Sequencers, dispensing is possible from that Sequencer.

If dispensing occurs before the SQCR POWER LOSS message is cancelled, flashing letters in the message indicate that dispensing is taking place as shown below:

SEQ XX PWR LOSS Flashing SEQ indicates O1 Category Dispensing
SEQ XX PWR LOSS Flashing XX P indicates O2 Category Dispensing
SEQ XX PWR LOSS Flashing WR L indicates CH Category Dispensing
SEQ XX PWR LOSS Flashing OSS indicates FL Category Dispensing

20.2.2.16 Displayed Inventory Considers Squib Power

The CDU will display inventory for sequencer(s) with valid reporting squib power. If a squib power failure is detected and if WOW is false (aircraft is airborne or WOW is override), the inventory displayed that is associated with the affected sequencer(s) will be removed. If squib power failure is no longer detected, the inventory displayed that is associated with the affected sequencer(s) will be added back.

Example:

Sequencer 1A, MAG A ID 10 Sequencer 1A, MAG B ID 10 Sequencer 2A, MAG A ID 04 If all dispensers are loaded, but squib power is unavailable to Sequencer 1A, the following inventory will be displayed:

01	O2	СН	FL
6	16		8

If squib power failure is no longer detected on Sequencer 1A, the following inventory will be displayed:

01	O2	СН	FL
6	58		26

20.2.2.17 Stuck Discrete Notice

During CBIT, the CDU will alert personnel when one of the four MWS discretes or Manual Dispense discrete is determined to be stuck to ground for more than 15 seconds. The CDU will display message "XXXX DISC FAIL", where XXXX can be MWS1, MWS2, MWS3, MWS4 or MAN, MAN5 or MAN6. The discrete fail message will be displayed once per power cycle. User can clear the message by rotating the PRGM switch to BIT position and release.

20.2.2.18 System Power Up

- 1. Apply power to aircraft.
- 2. Press MSN PWR Switch ON. Mission Power Switch is located on the center console pedestal labeled 9920A11, as depicted in Figure 20-14.
- 3. Verify that MCB41 Mission Bus circuit breaker, located on the co-pilot's CB panel, is engaged.
- 4. Verify ASE Warning, Flare Cont and Flare Pwr circuit breakers located on the auxiliary circuit breaker panel on top of the passenger compartment avionics rack, as depicted in Figure 20-15, are engaged.
- 5. Adjust OVHD PED and SUBPAN rheostat, as depicted in Figure 20-16, for CDU brightness.

Figure 20-14. Mission Power Switch

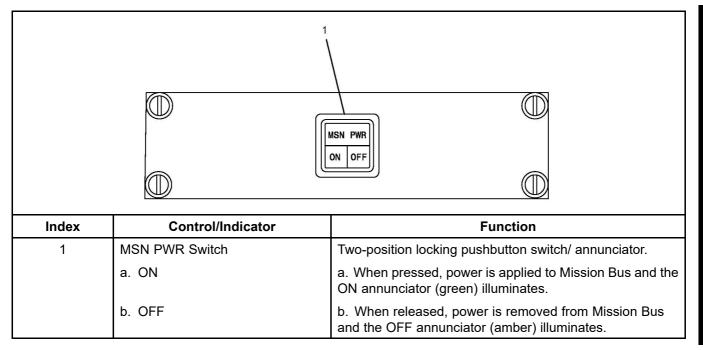


Figure 20-15. Auxiliary Circuit Breaker Panel

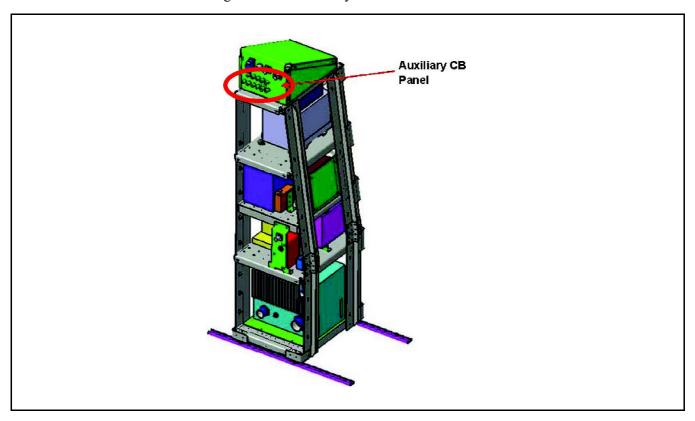


Figure 20-16. Overhead Pedestal and Subpanel Rheostat



20.2.2.18.1 CDU Operator Prompts at Power Up

The CDU displays operator prompts at power up; a list of operator prompts is depicted in Figure 20-4. To activate any prompt/function, rotate the PRGM switch from position 1 to position 2, then back to position 1. With the exception of the Zeroize function, the following functions are used for maintenance purposes. Category & Sensors Switches must be in the OFF position to access the following functions:

- 1. ?MAINTENANCE OP
 - a. ?HISTORY DATA
 - b. ?CLR FAULT LIST
 - c. ?ZEROIZE MDF
- 2. ?RPT SQUIB DATA
 - a. ?RPT Mispolls
 - b. ?RPT Dropouts
 - c. ?CLR Squib Data
- 3. ?SYSTEM CHECKOUT
 - a. ?RPT MAG IDS
 - b. ?RPT PGMR Discretes
 - c. ?Non Op MDF Load (Unclassified Maintenance MDF)

20.2.2.19 Dispense Switch Activation

- 1. Manual Programs 1-4 are selected on the CDU PRGM rotary switch. The selected dispense program is activated by pressing the Slap Dispense Switch on either the pilot or copilot side of glare shield, as depicted in Figure 20-17, or by moving the Instrument Panel Dispense Switch to the up position. Instrument Panel Dispense Switch is depicted in Figure 20-18.
- 2. Manual Program 5 is activated by moving the Instrument Panel Dispense Switch to the left position.
- 3. Manual Program 6 is activated by moving the Instrument Panel Dispense Switch to the right position.
- 4. Semi-Auto consent is activated by moving the Instrument Panel Dispense Switch to the down position. In current MDF Semi-Auto consent is not applicable because MWS response is automatic when in semi-auto mode.
 - a. Dispense Program is determined by CMDS in response to MWS discretes input.
 - b. Semi-Auto consent switch can be used to clear low stores level.

20.2.2.20 Training Mode/FTI Operation

- 1. On the CDU, place the MODE switch in STBY. Place the PRGM switch in 1.
- 2. On the CDU, rotate the PRGM switch to the BIT position.

Note

In the following steps, each CDU message is present for approximately five seconds.

- 3. To advance to the next message, on the CDU momentarily move the PRGM switch from 1 to BIT and back to 1.
- 4. When a question is presented,
 - a. Answer NO by either waiting for the message to expire (five seconds) or by moving the PRGM switch from position 1 to BIT and release.
 - b. To answer YES, on the CDU move the PRGM switch from position 1 to 2 and then back to position 1.

Figure 20-17. Pilot/Copilot Slap Dispense Switches

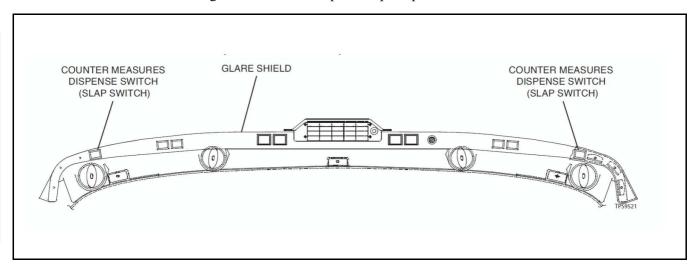


Figure 20-18. Instrument Panel Dispense Switch



20.2.2.21 MDF Zeroization

- 1. On the CDU, place the MODE Switch in STBY and allow CMDS to initialize.
- 2. Place the PRGM Switch in 1.
- 3. Press the O1, O2, CH, FL Category Inhibit switches and the RWR, MWS, and JMR Source Inhibit switches in the OFF position. In the following steps, each CDU message is present for approximately 5 seconds.
- 4. To quickly advance to the next message, momentarily place the PRGM Switch in the BIT Position.
- 5. When a question is presented, answer NO by either waiting for the message to time out or by pressing the PRGM switch.
 - a. To answer YES, move the PRGM switch from Position 1 to Position 2 and then back to Position 1.

MDF zeroization CDU display messages are depicted in Figure 20-19.

Figure 20-19. MDF Zeroization CDU Display Messages

MESSAGE	MEANING	ACTION
OFP#1136MDF#2764	Software loaded in the Programmer.	
TRN XXX FTI ON	Status of Training Mode and FTI.	
?TURN OFF FTI	Opportunity to turn FTI OFF.	Answer YES or NO as required.
?TURN ON TRN	Opportunity to turn TRN ON or OFF.	Answer YES or NO as required.
or ?TURN OFF TRN		
?MAINTENANCE OP	Opportunity to enter Maintenance Mode.	Move PRGM Switch on CDU from Position 1 to Position 2.
MAINTENANCE MODE	Indicates system is in Maintenance Mode.	Move PRGM Switch on CDU from Position 2 to Position 1.
OFP#1136MDF#2764	Software loaded in the Programmer.	
CCU-FIRM — ID 2031	Firmware loaded in the CDU.	
SEQ 1A — ID 3053	Software loaded in Sequencer 1A.	
SEQ 2A — ID 3053	Software loaded in Sequencer 2A.	
Pilot Fault List (if any)	Pilot Fault List data is shown.	
?HISTORY DATA	Opportunity to review the Maintenance Fault List data.	Answer NO.
?CLR FAULT LIST	Opportunity to clear the Maintenance Fault List data.	Answer NO.
?ZEROIZE MDF	An opportunity to zeroize the MDF in the programmer.	Move PRGM Switch on CDU from Position 1 to Position 2.
?CONFIRM ZEROIZE	An opportunity to cancel or confirm to proceed with zeroize.	Move PRGM switch from Position 1 to Position 2.
ZEROING MDF	Indicates the Zeroing process has started.	
ZEROING COMPLETE	MDF is deleted from Programmers EEPROM but not the RAM.	Move PRGM Switch on CDU from Position 2 to Position 1.
?RPT SQUIB DATA	Opportunity to review Squib Data.	Answer NO.
?SYS CHECKOUT	Opportunity to enter System Checkout.	Answer NO.

Figure 20-19. MDF Zeroization CDU Display Messages (cont.)

MESSAGE	MEANING	ACTION
	System returns to normal operation until power is removed.	System is powered down then powered up.
PROG FAIL GO BYP	Indicates there is no MDF in the Programmer.	

20.2.3 AN/ALE-47 CMDS Limitations and Constraints

Operations with the AN/ALE-47(V) installed does not impose any additional platform limitations or constraints.

20.2.4 AN/ALE-47(V) CMDS Employment Considerations

20.2.4.1 Source Priority

The Source Priorities are defined in the MDF and are used to determine which source takes priority over the other sources. (Figure 20-20) When a dispense is occurring for a specific source if another source of a higher priority is requested then any categories being dispensed in the lower priority source will be interrupted by the higher priority source. If the category currently being dispensed by the lower priority source is not being used in the higher priority source then that category will continue to be dispensed and the two sources will merge.

 Priority
 Source

 1
 MWS

 2
 MAN 3

 3
 MAN 1, 2, 4

 4
 MAN 6

 6
 MAN 5

Figure 20-20. MDF 2763/2764 Source Priorities

20.2.4.2 Expendables Management

20.2.4.2.1 Payload/Zone Substitution

The CMDS has the capability to substitute payload types within or across a category during dispensing (i.e., two MJU-49 flares for one MJU-32 flare). Payload types can be combined into payload categories such as O1 (Other 1), O2 (Other 2), chaff and flares. The Programmer receives inventory data by type from the internal system control function and allowable substitutions from the MDF. It provides the payload inhibit function with substitution payload types and quantities when the specific payload type is known. Payload and zone substitutions are defined in the MDF.

20.2.4.2.2 Category Enable/Inhibit and Sensor

Payload ON/OFF on the CDU enables the CMDS to dispense payloads. Each category and sensor must be armed separately. The payload inhibit switch provides a means of conserving expendables or coordinating responses with other aircraft systems. If a reprogrammable low quantity (via MDF) of an expendable category is reached, the CMDS can inhibit further dispensing in the automatic mode of that expendable type until the operator initiates override of the inhibit function. The operator can manually inhibit dispensing of each payload category, and inhibit dispense requests from the MWS. The payload inhibit performs the following:

20.2.4.2.3 Low Stores Limits

The MDF has a Low Stores limit (minimum remaining inventory) value for each category. When the Low Stores limit is reached, a Lo message appears in the inventory display next to each affected inventory value. In MDF

2763 and later low stores is advisory only and will not stop dispensing. There are two ways to clear the low stores indications:

- 1. Activate the Semi-Auto Consent by actuating the Dispense Initiate Switch to the SEMI position;
- 2. Cycle the Category Inhibit switch for the category at Low Stores level to the ON position.

Toggle switch from ON to OFF and then back to the ON position. To clear all set low stores limits simultaneously, actuate the Dispense Initiate switch to the Semi-Auto Consent position. Manual Programs are not affected by low stores limits. MDF 2763 and later is programmed with a Low Stores limit (minimum remaining inventory) value of Zero (0) for Chaff, Six (6) for Flare, Two (2) for Other 1, and Eight (8) for Other 2.

20.2.4.3 MDF Dispense Programs

MDF Dispense Programs are classified and defined in Appendix A.

20.2.4.4 Emergency Jettison

Jettison provides an emergency capability to dispense hazardous payloads. The JETT (Jettison) switch is a two-position toggle switch with a mechanical interlock to prevent inadvertent activation. When power is available to the CMDS (Mission Power ON and CMDS circuit breakers pushed in), activating the JETT switch when the Safety Switch pin is NOT installed and when the Weight-On-Wheels circuitry determines that the aircraft is airborne WILL result in the immediate rapid dispensing of all FL, O1, and O2 inventory.

Jettison overrides all CMDS modes including OFF and Training Mode. If the Safety Switch pin is fully engaged, the CMDS will not jettison.

Expendable categories that contain flares and other IR decoy devices are usually programmed as jettisonable. Jettison may also be used in attempting to dispense payloads that misfire or fail to poll. In MDF 2763 and later the MJU-32, MJU-57 and MJU-49 are programmed to jettison.

The Jettison program takes approximately 22 seconds to complete. If the JETT switch is activated when the safety pin is installed, the CMDS will attempt to dispense jettisonable expendables. If the safety pin is removed while the Jettison program is still running (22 seconds), expendables could dispense.

Note

- Jettison WILL dispense in ALL CMDS modes including OFF unless one of the following conditions exists:
 - The CMDS safety pin is fully engaged.
 - The aircraft has weight on wheels (WOW).
 - The Mission Power switch is off.
 - The FLARE PWR circuit breaker is pulled.
- If the JETT switch is activated with weight on wheels, the JETT switch must be cycled OFF to JETT after weight is off wheels to initiate a jettison sequence.

20.2.4.5 Unintentional Dispensing of Expendables

Dispensing flares at low altitude could also be a significant fire hazard.

- 1. To prevent unintentional dispensing of expendables, ensure that the AN/ALE-47(V) mode switch is in STBY.
- 2. When the AN/AAR-47 MWS is powered on and the AN/ALE-47(V) is placed in SEMI or AUTO mode with the MWS sensor switch is ON, MWS auto dispense may occur without aircrew consent.

20.2.5 Safety Considerations

The following paragraphs summarize potential safety and operational hazards associated with the AN/ALE-47(V) CMDS.

20.2.5.1 Emergency Ground Egress

Flares are constructed of materials that burn at extremely high temperatures. The initiators and squibs are extremely flammable as well. An aircraft fire in the vicinity of the magazines may cause expendables to ignite. Stay clear of all expendable magazines since any loaded expendables cartridges may ignite.

20.3 AAR-47 MISSILE WARNING SET (MWS)

The AN/AAR-47 MWS is designed to passively detect attacking IR missiles and battlefield lasers (Range Finder, Target Designator, and Beam Rider missiles), while minimizing false alarms. When an attacking IR missile is detected, the MWS sends a flare-eject signal to the AN/ALE-47 Countermeasures Dispensing Set (CMDS). For all detected threats, the MWS also provides audio and visual alerts to the aircrew. The following paragraphs outline the theory of Missile Warning. Refer to A1-C12WA-NFM-010 Classified NATOPS Flight Manual Aircraft Survivability Supplement for additional theory about the AAR-47 operation.

20.3.1 Missile Warning

The AN/AAR-47 MWS sensors operate in the ultraviolet (UV) spectrum, where the earth's ozone layer absorbs all in-band photons (radiation) from the sun. The four sensors are wide field of view (FOV) detectors that sense in-band UV radiation from the rocket motor plume of missiles as well as other man-made sources, and converts the UV radiation into electronic signals. The MWS evaluates the four photon count streams for temporal patterns that distinguish an attacking IR missile from all other sources of UV radiation. Each sensor is a single-point detector and sees the sum of all in-band UV photons in its FOV. The MWS does not know how many sources contributed to the sum, or how they are distributed within the FOV. The missile detection algorithm has temporal patterns to accommodate near, mid, and far range attacks. The system provides quadrant indication.

20.3.2 Laser Warning

For laser detection, the sensor detects laser pulses in the 0.5 to 1.6 micron region. Detection is based on the extremely fast rise time of a pulsed laser. The High Angular Resolution Laser Irradiance Detector (HARLIDTM) provides azimuth angle of arrival (AOA) information. The more sensitive photodiode is limited to quadrant detection, but has the ability to detect very weak laser signals. Laser detection software in the sensor de-interleaves pulses from multiple lasers and determines the pulse repetition interval (PRI) for each detected laser. The sensor sends this information, and a detected power level to the Signal Processor. Software classifies each laser (Range Finder, Designator or Beam Rider) based on PRI, consolidates the same laser reported by adjacent sensors, and displays the results. There is no countermeasures response to a laser warning detection.

20.3.3 Hostile Fire Indication (OFP 30.41 Only)

For Hostile Fire Indication (HFI), the AN/AAR-47 evaluates the same UV photon count streams that the missile warning detection algorithms use. These algorithms detect small arms and unguided munitions that are directed at the aircraft and attempts to ignore those directed away. This is done by attempting to match a specific temporal pattern or by measuring the angular rate of change of the projectile's photon count as it passes by two or more sensors. Once the MWS identifies HFI, it provides quadrant indication alarm to the aircrew.

20.4 AUTHORIZED CONFIGURATIONS

20.4.1 AN/AAR-47A(V)2

AN/AAR-47A(V)2 is authorized. The authorized operational flight programs (OFP) for AN/AAR-47A(V)2 are 22.40, 30.24, or 30.41. The authorized Control Indicator software versions are 1.00, 1.01, or 1.02. The authorized sensor software loads for the AN/AAR-47A(V)2 are 1.03 and 1.04.

Authorized AN/AAR-47 OFP software may be downloaded from the Naval Data Distribution System (NDDS) website on SIPR net (https://NDDS.mugu.navy.smil.mil) or on NIPR net (https://ndds.navair.navy.mil).

Note

AN/AAR-47 OFP software downloaded from NDDS is unclassified.

20.4.2 AN/AAR-47B(V)2

AN/AAR-47B(V)2 is authorized. The authorized operational flight programs (OFP) for AN/AAR-47B(V)2 are 30.24 and 30.41. The authorized Control Indicator software versions are 1.00, 1.01, or 1.02. The authorized sensor software loads for AN/AAR-47B(V)2 are 1.03 and 1.04.

Authorized AN/AAR-47 OFP software may be downloaded from the Naval Data Distribution System (NDDS) website on SIPR net (https://NDDS.mugu.navy.smil.mil) or on NIPR net (https://ndds.navair.navy.mil).

Note

AN/AAR-47 OFP software downloaded from NDDS is unclassified.

20.4.3 System Description and Components

The AN/AAR-47 MWS is a passive electro-optical threat warning system designed with integrated laser warning circuits to detect surface-to-air missiles and warn of laser aided or laser guided threats, and warn of small arms and unguided munitions threats. The MWS detects the exhaust plume radiation emissions that emanate from a missile fired at the aircraft and discriminates against false targets and those missiles not aimed at the aircraft.

The MWS provides 360 degree coverage for the aircraft with coverage divided into four 90-degree zones centered at 45, 135, 225, and 315 degree relative headings. Missile Warning (MW) and HFI threats are displayed as being at one of these four relative headings. Laser Warning (LW) threats are displayed with the threat classification and AOA or quadrant in relative heading. HFI and LW alerts provide aircrew situational awareness only; no countermeasure is launched. The system interfaces with the AN/ALE-47 CMDS to provide automatic operation in an environment that is beyond the capabilities of pilot reaction time for countermeasures.

The nomenclatures for the system components that make up the MWS are the Countermeasures Signal Processor (CP), Control Indicator (CI) or other display, and Integrated Optical Sensor Converters (IOSC). A block diagram of the MWS is depicted in Figure 20-21.

20.4.3.1 Countermeasures Signal Processor (CP)

The CP, depicted in Figure 20-22, is located in the passenger compartment avionics rack and contains the electronics and software that perform the data processing and input/output functions of the MWS. The CP receives and processes MW and LW signals from the IOSCs. When an attacking missile is detected, the CP sends a flare-eject signal directly to the AN/ALE-47(V) CMDS.

20.4.3.2 A(V)2 Integrated Optical Sensor Converter (IOSC)

Each IOSC, as depicted in Figure 20-23, contains UV and LW functions. The MW optics, at the top of the IOSC, collects UV radiation and filters out photons of the wrong wavelength. There are two LW detectors. The photodiode on the lower right detects the signals from low power laser Beam Riders, Range Finders, and Designators. The other laser detector is a HARLIDTM that provides a precise angle of arrival for high power Range Finders and Designators. A third photodiode (Adjunct Detector), located to the left of the HARLIDTM detector, works with the IOSC blanking circuitry to protect the IOSC from saturation during periods of intense in-band radiation. The IOSC must be mounted correctly with the \(^1\text{UP}\) etched in the top of the IOSC, oriented at the top, in order to provide the correct LW angle of arrival information to the aircrew.

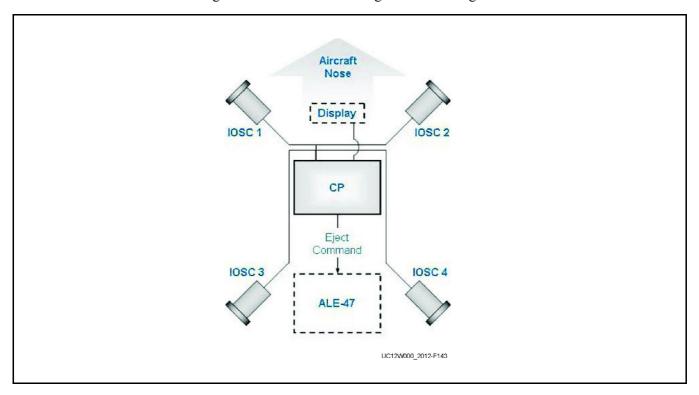
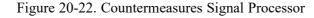


Figure 20-21. Missile Warning Set Block Diagram





Each IOSC located on the aircraft exterior is installed to provide staring coverage of one aircraft quadrant. Figure 20-24 depicts the forward starboard IOSC location and Figure 20-25 depicts the aft starboard IOSC location. The optical sensor converters contain nickel sulfate, a hazardous material in powdered form. If a sensor is broken, do not pick up the remnants without protective gear.



Contact with nickel sulfate without protective gear may result in skin irritation or burning.

Note

The IOSC must be mounted correctly with the \uparrow UP \uparrow etched in the top of the IOSC, oriented at the top, in order to provide the correct angle of arrival information to the aircrew.

Figure 20-23. A(V)2 Integrated Optical Sensor Converter

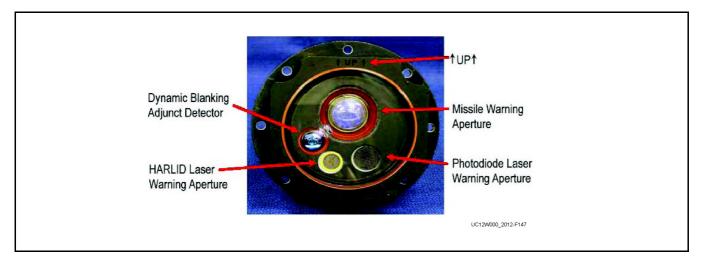


Figure 20-24. Forward Starboard IOSC Location

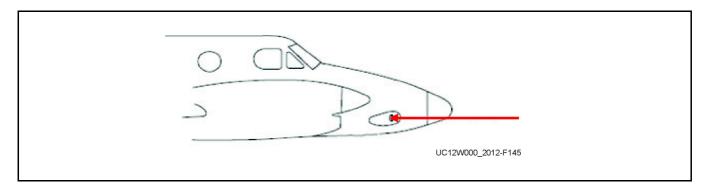
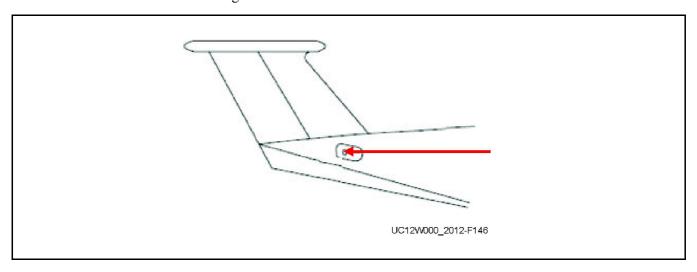


Figure 20-25. Aft Starboard IOSC Location



20.4.3.3 B(V)2 Integrated Optical Sensor Converter (IOSC)

Each IOSC, as depicted in Figure 20-26, contains UV and LW functions. The MW optics, at the top of the IOSC, collects UV radiation and filters out photons of the wrong wavelength. There are two LW detectors. The photodiode on the lower right detects the signals from low power laser Beam Riders, Range Finders, and Designators. The other laser detector is a HARLID™ that provides a precise angle of arrival for high power Range Finders and Designators. A third photodiode (Adjunct Detector), located to the left of the HARLID™ detector, works with the IOSC blanking circuitry to protect the IOSC from saturation during periods of intense in-band radiation. The IOSC must be mounted correctly with the ↑UP↑ etched in the top of the IOSC, oriented at the top, in order to provide the correct LW angle of arrival information to the aircrew.

The B(V)2 sensor has an additional capability to detect noise patterns in the UV clutter (tonal noise). It subtracts such tonal noise and evaluates the cleaned-up signal for the presence of an attacking IR missile, passing its results to the CP for consideration by the missile-detection algorithm. This is the key to the B(V)2s enhanced Probability of Timely Missile Detection (Pd), but it comes with a small increase in false alarm rate (FAR). This Pd enhancement only pertains to MW and does not benefit HFI. Refer to A1-C12WA-NFM-010 NATOPS Flight Manual Aircraft Survivability Supplement for additional information about the B(V)2 sensor and FAR.

Each IOSC located on the aircraft exterior is installed to provide staring coverage of one aircraft quadrant. Figure 20-24 depicts the forward starboard IOSC location and Figure 20-25 depicts the aft starboard IOSC location. The optical sensor converters contain nickel sulfate, a hazardous material in powdered form. If a sensor is broken, do not pick up the remnants without protective gear.



Contact with nickel sulfate without protective gear may result in skin irritation or burning.

Note

The IOSC must be mounted correctly with the \(^1UP\) etched in the top of the IOSC, oriented at the top, in order to provide the correct angle of arrival information to the aircrew.

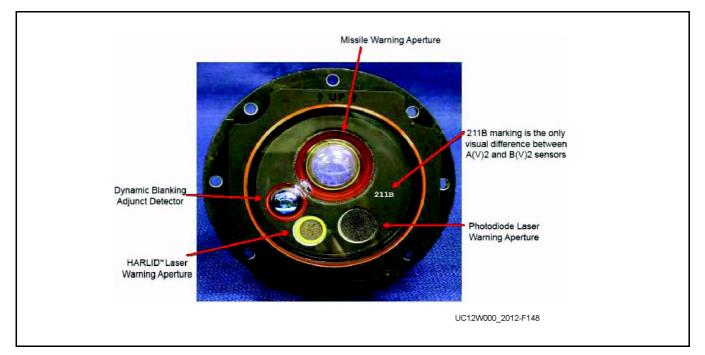


Figure 20-26. B(V)2 Integrated Optical Sensor Converter

20.4.4 Mission Computer

(Platform Specific)

20.4.5 Controls and Displays

20.4.6 Control Indicator (CI)

The CI, as depicted in Figure 20-27, located on the instrument panel, provides system on/off control, initiates system built-in-test (BIT), displays BIT, LW, HFI, and/or MW indications. The alphanumeric display is aviator's night vision imaging system (ANVIS) green and the rosette pattern is ANVIS yellow. The CI also provides an audible warning signal to the aircraft crew when missile and laser threats are declared.

20.5 SYSTEM OPERATION

20.5.1 Modes of Operation

The MWS has four modes of operation.

20.5.1.1 Power up Mode

Power up mode is the condition during which electrical power is applied to the MWS and system control is turned on. The MWS undergoes warm up, and stable operation is achieved consistent with the sensed system configuration. Upon power up, presence of a valid OFP is determined. In the absence of a valid OFP, the CP transitions into a reprogramming maintenance mode. In the presence of a valid OFP, the CP determines the MWS configuration and performs power up BIT (PBIT) to verify MW and LW functionality and transitions to the operating mode.

20.5.1.2 Operating Mode

The operating mode is the condition following power up where the MWS has achieved stable operation, is performing the missile and laser warning, and is communicating with external systems. The MWS continuously processes all available MW and LW sensor data, detects threats, monitors signal characteristics for continuous BIT (CBIT), displays BIT status, and accepts laser blanking signals from the aircraft to preclude response to onboard

laser sources. In the presence of a MW or LW threat, the MWS generates warning signals representing threat declaration, displays the threat quadrant for MW and angle of arrival for LW, and sends a countermeasure dispense command to the CMDS for MW. The MWS attempts to maintain operation in the presence of faults such as a failed IOSC or IOSC sub-functions, communication/BIT failures with internal devices (CI, IOSC), or communication failures with external devices. Once a device failure is detected/reported, the MWS ignores invalid data from that device as determined by the nature of the device failure.

The BIT mode is the condition where the MWS performs self-test based upon some manual intervention, with or without support equipment. This mode includes: Initiated BIT (IBIT), Organizational-level functional test (OLFT), and Organizational level sensitivity test (OLST). The IBIT mode performs IBIT of the MWS components to achieve fault detection. IBIT is entered from the operating mode when system BIT is manually activated from the user control. Upon completion of the process, the MWS automatically transitions back to the operating mode. OLFT and OLST are maintenance modes. The OLFT performs IOSC functional test to achieve WRA fault isolation. The OLST mode performs an IOSC MW sensitivity test to verify the MW characteristics of the IOSC. The OLFT and OLST modes are entered from the operating mode when manually activated from the user control.



Figure 20-27. Control Indicator

UC12W000 2012-F149

CONTROL/INDICATOR	POSITION	FUNCTION/INDICATION
	OFF	Interrupts all power.
DIAID (MODE) CIAITOU	ON	Applies power.
PWR (MODE) SWITCH	TEST	Spring-loaded position causes the MWS to step through a sequence of modes displaying each for two seconds. Releasing the switch selects the displayed mode.
STATUS DISPLAY		Provides two rows of four alphanumeric characters for message display. ANVIS Green.
	QUADRANT ARROWS	Indicates missile warning detection quadrant.
THREAT DISPLAY	CIRCULAR ROSETTE	24-segment light emitting diode (LED) circular rosette for Laser Warning angle of arrival direction information. ANVIS Yellow.
	BR	Indicates a Beam Rider laser warning.
	D	Indicates a Designator laser warning.
	R	Indicates a Range Finder laser warning.
LAMP KNOB Controls the light intensity of the on the CI.		Controls the light intensity of the display and control panel on the CI.
AUDIO KNOB Controls the volume for the multiple warning pilots' headset.		Controls the volume for the multiple warning tones to the pilots' headset.
The control indicator is backli	t. Dimming control is	s self-contained, controlled by the LAMP switch.

20.5.1.3 BIT Mode

20.5.1.4 MW Event Logging Mode

MW event logging mode operates with OFP 22.40 and OFP 30.41. The MW event logging mode is the condition where the CP transfers data associated with MW alarms from its volatile to non-volatile memory. Whenever a MW alarm is generated, the CP automatically stores UV photon counts from each sensor and, when available, platform data, in volatile memory. The event logging mode disables MW functionality and should only be attempted in non-operational environments. Up to six events can be saved in non-volatile memory. The memory buffer is circular, so when the aircrew attempts to save a seventh event, the oldest saved event is overwritten. Events in volatile memory are lost when MWS power is lost. Saved MW data can be downloaded for later engineering analysis using a Memory Loader-Verifier Set.

Note

In OFP 30.24, the SAVE LOG feature is non-functional. If selected in OFP 30.24, the MWS will cease operation, requiring power to be cycled OFF/ON.

20.5.2 System Activation

Placing the PWR switch in the ON position commands the system to perform the PBIT. When BIT is complete and the system has no malfunctions, MWS RDY will be displayed on the CI.

Note

- Cycling the power switch at any time will result in the system being non-operational for approximately 30 seconds as a result of repeating the power-up sequence.
- The countermeasures dispenser must be loaded, turned on, and properly programmed in accordance with applicable instructions before countermeasures can be dispensed.

20.5.2.1 Self-Test/BIT Procedures

The MWS contains BIT features that provide both a failure detection function and a failure location function.

20.5.2.1.1 PBIT

PBIT is activated whenever the MWS is first energized. Each sensor, CP, and the CI performs a self-test. The results of the test are displayed on the CI alphanumeric display. Refer to Figure 20-28 for normal PBIT indications. Refer to Figure 20-29 for PBIT failures and abnormal indications.

20.5.3 Control Indicator OFF/ON/TEST Switch

Holding the OFF/ON/TEST switch to the spring-loaded TEST position causes the MWS to walk through a sequence of mode choices; displaying each for two seconds. Releasing the switch selects the displayed mode. The available modes are depicted in sequence in Figure 20-30.

Figure 20-28. Normal PBIT Indications

FUNCTION	DISPLAY
Power On Indicator Self-test. Tests all lamp functions. 1. Alphanumeric display shows checkerboard pattern. 2. Four audio tones are heard. 3. Missile Warning (MW) quadrant arrows (4) are illuminated. 4. Laser Warning (LW) rosette is fully illuminated and is bright in intensity. 5. Laser Warning indicators D, BR, and R located within the rosette are	OFF BR AUDIO R TEST PWR STATUS THREAT LAMP UC12W000_2012-F150
illuminated.	
Control Indicator software version.	OFF CI V BR AUDIO TEST PWR STATUS THREAT LAMP UC12W000_2012-F150a
Hardware configuration.	OFF MWS ON (V)2 TEST PWR STATUS THREAT LAMP UC12W000_2012-F1506
OFP Version.	OFF OFP ON 3024 TEST PWR STATUS THREAT LAMP UC12W000_2012-F150c
IOSC and CI BIT.	OFF MWS BIT PWR STATUS THREAT LAMP UC12W000_2012-F151

Figure 20-28. Normal PBIT Indications (cont.)

FUNCTION	DISPLAY
PBIT successful.	OFF BIT AUDIO AUDIO
	PWR STATUS THREAT LAMP UC12W000_2012-F151a
PBIT complete, system ready.	OFF MWS AUDIO
	PWR STATUS THREAT LAMP UC12W000_2012-F151b

Figure 20-29. PBIT Failure Indications

CONDITION	DISPLAY		
Control Indicator fails BIT.	OFF CI AUDIO AUDIO DE LAMP CUC12W000_2012-F152		
CI not communicating with CP. BIT Failure Tone will sound.	COMM FAIL PWR STATUS THREAT LAMP UC12W000_2012-F152a		
CP fails BIT. BIT Failure Tone will sound.	OFF CP AUDIO AUDIO FAIL PWR STATUS THREAT LAMP UC12W000_2012-F152b		
IOSC fails BIT (Failed IOSC indicated, rosette quadrant of failed IOSC blanked. BIT Failure tone will sound.)	OFF 3 BR AUDIO TEST PWR STATUS THREAT LAMP UC12W000_2012-F152c		

Figure 20-30. MWS Test Position

MODE DISPLAY	MODE	WHEN PWR SWITCH RELEASED, CI DISPLAY CHANGES TO:	FUNCTION INITIATED	
IBIT RQST	IBIT Request	BIT MWS	An in-depth system test performed, interrupting the normal operation (MW and LW function) of the system. Failures are reported to the Cl. At completion, normal operation resumes.	
OLFT RQST	O-Level Function Test Request	LW OBIT MW followed by FBIT	Laser Warning BIT followed by O-Level Functional Test. Allows a functional end to-end test of the system using support equipment. The illumination of each IOSC with the tester should result in a MW alarm. The MWS remains in this mode until manually terminated. To terminate, hold CI OFF/ON/TEST switch to TEST until OBIT TERM is displayed and release. Normal operations resume.	
OLST RQS	O-Level Sensitivity Test Request	MW SBIT	Allows a sensitivity test of each IOSC using support equipment. Sensitivity is measured as the Photon Irradiance Response (PIR). The MWS remains in this mode until manually terminated. To terminate, hold CI OFF/ON/TEST switch to TEST until OBIT TERM is displayed and release. Normal operations resume.	
CANC RQST	Cancel Request	MWS RDY	Ends the cycling through the non-operational modes and returns to normal operation. No test will be run.	
LW OFF/ON	Laser Warning Off	LW OFF/ON	Toggles Laser Warning threat reporting off and on. Default value is ON. When switched to OFF, the LW portion of the MWS continues to operate normally, the CI display and audio for LW are turned off. Releasing the ON/OFF/TEST switch to select LW ON/OFF mode will toggle the mode to the opposite of the currently selected mode (e.g., If ON, selecting the LW ON/OFF mode will toggle the mode to OFF).	
CLI ON/OFF	Clutter Level Indicator On	CLI ON/OFF	Toggles CLI ON or OFF. Default value is OFF. Normal AAR-47 operation continues regardless of CLI mode. Releasing the ON/OFF/TEST switch to select CLI ON/OFF mode will toggle the mode to the opposite of the currently selected mode (e.g., If ON, selecting the CLI ON/OFF mode will toggle the mode to OFF).	

Figure 20-30. MWS Test Position (cont.)

MODE DISPLAY	MODE	WHEN PWR SWITCH RELEASED, CI DISPLAY CHANGES TO:	FUNCTION INITIATED		
CANC RQST	Cancel Request	MWS RDY	Ends the cycling through the non-operational modes and returns to normal operation. No test will be run.		
HFI OFF/ON (OFP 30.41 Only)	Hostile Fire Indicator OFF	HFI OFF/ON	Toggles HFI ON or OFF. Default value is OFF. Normal AAR-47 MW operation continues regardless of HFI mode. When toggled OFF, no HFI processing occurs in the CP. Releasing the ON/OFF/TEST switch to select HFI ON/OFF mode will toggle the mode to the opposite of the currently selected mode (e.g., If ON, selecting the HFI ON/OFF mode will toggle the mode to OFF).		
SAVE LOG	Save Event Log	DATA LOG	Transfer MW alarm data to non-volatile memory. At completion, normal operation resumes. Note • With OFP 30.24 installed, if SAVE LOG is selected the MWS will cease operation, requiring power to be cycled OFF/ON. • SAVE LOG mode is functional with OFP 30.41 installed.		
		Note			
MW and LW functionality is not available while the modes are activated.					

20.5.4 Threat Displays

20.5.4.1 Missile Warning

Only one MW threat can be displayed at a time. When a missile warning is reported, as depicted in Figure 20-31, the following alerts occur:

- 1. MW and relative azimuth quadrant angle indication (45, 135, 225, 315) on the alphanumeric display;
- 2. Quadrant arrow indication;
- 3. Aural warning.

20.5.4.2 Laser Warning

20.5.4.2.1 Laser Displays

Up to three LW threats can be displayed at one time. When a laser warning is reported, as depicted in Figure 20-32, the following alerts occur:

1. LW and relative azimuth angle indication on the alphanumeric display, displays the highest priority threat for multiple laser threats;

- 2. Compass rosette indication. Indicates up to three laser threats;
- 3. Threat classification (R, D, BR), displays the highest priority threat for multiple laser threats;
- 4. Aural warning.

Note

A countermeasures flare-eject signal is not sent for a detected laser threat.

20.5.4.2.2 Laser Off/On Toggle Switch

OFP 30.24 gives CI users the ability to toggle LW threat reporting on and off. At MWS power-up, LW displays default to on.

Refer to Figure 20-30 for procedures to toggle LW OFF/ON.

The AAR-47 continues normal laser operations, regardless of selected display status. When "LW OFF" is selected, CI displays and audio for LW are turned off. When "LW ON" is selected, displays are active.

20.5.4.3 Hostile Fire Indication (OFP 30.41 Only)

Only one HFI threat per quadrant can be displayed at a time. When an HFI event is reported, as depicted in Figure 20-33, the following alerts occur:

- 1. HFI on alphanumeric display;
- 2. Quadrant indication on the compass rosette;
- 3. HFI unique aural warning.

Note

A countermeasures flare-eject signal is not sent for a detected hostile fire threat.

Figure 20-31. Sample MW Threat Display



Figure 20-32. Sample LW Threat Display



Figure 20-33. Sample HFI Threat Display



20.5.4.3.1 HFI Off/On Toggle Switch

OFP 30.41 gives CI users the ability to toggle HFI threat reporting on and off. At MWS power-up, HFI displays default to off. Refer to Figure 20-30 for procedures to toggle HFI Off/On.

20.5.4.4 Threat Display Priorities

In a multiple threat environment, the CP determines which threats will be displayed and in which order. The threat priorities are:

- 1. Beam Riders.
- 2. Missile Threats.
- 3. Laser Designators.
- 4. Hostile Fire (OFP 30.41 Only).
- 5. Range Finders.

If a lower priority threat is being displayed when a higher priority threat is detected, the higher priority threat takes precedence. Threats take precedence over other displays such as Faults, Blanking, and Clutter Level.

20.5.4.5 Blanking Indication

Blanking is the ability of the sensor to protect itself against extremely high levels of in-band light. When the IOSC goes into blanking, MW and HFI functions are interrupted for that sensor until the condition goes away. The adjunct photodiode continues the photon count during blanking, and notifies the system when it is safe to return to normal operation.

OFP 30.24 and subsequent displays X BLNK, with X being the number of the affected IOSC. The arrow of the affected quadrant will be removed from the rosette, as depicted in Figure 20-34. Only those blanking events which exceed a specified length of time are displayed.

20.5.4.5.1 Clutter Level Indication

OFP 30.24 and subsequent provides the ability to display clutter level for each sensor. The clutter level display reports the average of the UV in-band noise for each sensor and is updated every 5 seconds. When clutter level indication (CLI) is enabled, each sensor's clutter level is displayed on the CI alphanumeric display in their relative positions. Three report levels are available: Low (L), Medium (M) and High (H). A typical display is depicted in Figure 20-35. At power up, CLI defaults to OFF. Once enabled, CLI remains displayed until toggled OFF. Refer to A1-C12WA-NFM-010 NATOPS Flight Manual Aircraft Survivability Supplement for more information on clutter levels. Refer to Figure 20-30 for procedures to toggle CLI ON/OFF.

20.6 PREFLIGHT MAINTENANCE/INSPECTION

Preflight maintenance consists of visually inspecting each sensor and cleaning it (soapy water is usually adequate, though a solvent such as acetone may also be used). Since the sensor is non-imaging, small digs and scratches in the optical surface do not impair its functionality. Preflight inspection is limited to a visual inspection of each sensor.

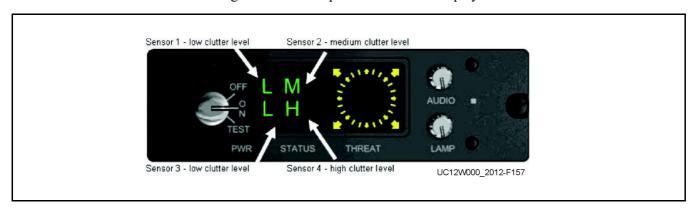
Note

It is important that each sensor be cleaned. A slight film build-up on the sensor will not appear significant, but can cause up to a 50 percent loss of sensitivity.

Figure 20-34. Sample Blanking Display



Figure 20-35. Sample Clutter Level Display



20.6.1 MW Event Logging

When an MW event occurs, the aircrew can save the data associated with this event for later analysis. Up to six events can be saved, in non-volatile memory, and downloaded post flight using a Memory Loader-Verifier Set. The memory buffer is circular, so when the aircrew attempts to save a seventh event, the oldest saved event is overwritten. Events saved in the Data Log must be saved prior to shutting down the MWS. Refer to Figure 20-30 for SAVE LOG procedures.

Note

The SAVE LOG feature is non-functional in OFP 30.24. If selected, MWS will cease operation, requiring power to be cycled OFF/ON. SAVE LOG mode is functional with OFP 22.40 and 30.41 installed.

20.7 LIMITATIONS AND CONSTRAINTS

- 1. Operations with the AN/AAR-47 installed do not impose any additional platform limitations or constraints.
- 2. Use of the SAVE LOG mode is not authorized with software OFP 30.24 installed.

Note

If SAVE LOG is selected with OFP 30.24 installed, the MWS will cease operation, requiring power to be cycled OFF/ON.

20.8 EMPLOYMENT CONSIDERATIONS

20.8.1 ALE-47 Interface

The AN/AAR-47 should not be turned on with the AN/ALE-47(V) armed unless in an area approved for expending countermeasures.

Note

Inadvertent dispensing of countermeasures may occur whenever the AN/AAR-47 MWS is active with the ALE-47 CMDS armed.

PART IX

Flightcrew Coordination

Chapter 21 — Flightcrew Coordination

CHAPTER 21

Flightcrew Coordination

21.1 INTRODUCTION

Crew resource management is the responsibility of the Transport Plane Commander (TPC). In this chapter, specific responsibilities are delineated by crew position and by phase of flight. The structure of these responsibilities mandates good communication between each member of the aircrew team. The Transport Aircrewman (TA) is an integral part of the aircrew team and should be utilized to the fullest extent possible. As always, the TPC is responsible for the successful completion of any assigned mission. All crewmembers must be familiar with the concept and requirements of this chapter. Utilizing each crewmember to his/her full capability ensures good crew resource management.

21.1.1 Crew Resource Management (CRM)

The program is described in full in CNAF M-3710.7 and is intended to improve safety and mission effectiveness throughout the aviation community by enhancing crew coordination and communication. The seven critical behavioral skills are:

- 1. Decision Making Gather data, identify alternatives, provide rationale, and make an informed decision based on the information available.
- 2. Assertiveness Advocate a specific course of action, maintain position when challenged, and maintain position until convinced by facts presented that position is wrong.
- 3. Mission Analysis Define tasks, question data to devise a plan, critique existing plan, create contingency plans, and coordinate, allocate, and monitor crew and aircraft resources.
- 4. Communication Use standard terminology, exercise two-way communication, receive communication, verify accuracy of statement, request clarification if necessary, and provide feedback.
- 5. Leadership Direct and coordinate tasks to be completed, ask for input, assign tasks to crew, provide feedback, and encourage crew to act as a team.
- 6. Adaptability/Flexibility Alter course of action and/or behavior to meet situational demands and maintain constructive behavior under pressure.
- 7. Situational Awareness Be aware of mission status, navigational requirements, and aircraft/systems performance and how they relate to what is supposed to be happening.

Practicing CRM principles will improve mission effectiveness and reduce mishaps resulting from poor crew coordination.

21.1.2 Checklist Usage

Flow patterns for the UC-12W aircraft are an integral part of good operating procedures. Configuring the aircraft for a phase of flight should be accomplished in a logical sequence on an as-needed basis, then confirmed by use of the challenge and response checklists. Use of normal checklists is for validation that tasks have been accomplished and that the cockpit and aircraft are properly configured for the next phase of flight.

A flow pattern for the UC-12W is included in this chapter. It is a disciplined procedure. It requires that pilots know their aircraft and systems and that they accomplish its configuration methodically.

Checklists shall be initiated by command from the PF. Good airmanship requires that if, in the opinion of the PNF, initiation of the checklist has been overlooked, the PNF inquire of the PF if the checklist should be started. Such prompting is appropriate in a professional cockpit in any flight situation (e.g., training, operations, or checkrides).

In execution of the checklist, the PNF reads each checklist item aloud. Items that are the responsibility of the PF are validated as accomplished and the PF verbally responds (CHALLENGE — RESPONSE). The items that are PNF responsibility are validated as having been accomplished and the PNF verbally confirms this (CHALLENGE — RESPONSE).

Effective checklists are pertinent and concise. Use them verbatim, smartly, and professionally. The pilot designated to fly the aircraft (PF) does not perform tasks that compromise this responsibility.

21.2 DEFINITIONS

The following definitions are provided for a better understanding of flightcrew coordination:

- 1. Transport Plane Commander (TPC) The pilot assigned responsibility for safe and orderly conduct of the aircraft.
- 2. Pilot Flying (PF) The pilot responsible for controlling the flight of the aircraft.
- 3. Pilot Not Flying (PNF)/Copilot The pilot/NFO-QO responsible for assisting the PF as required.
- 4. Left Seat/Right Seat (LS/RS) pilot station Designation of seat position for accomplishing a given task because of proximity to the respective control/indicator. Regardless of PF or PNF role, the pilot/NFO-QO in that seat position performs tasks and responds to checklist challenges accordingly.
- 5. Transport Aircrewman (TA) A designated Naval Aircrewman who is NATOPS qualified in model. Specific responsibilities are detailed in paragraph 21.3.3.

21.2.1 Challenge No Response

If a flight deviation or critical situation is observed by the PNF and there is no response by the PF to his/her challenge, a second challenge must be made. Response, as used herein, means verbal response as well as appropriate action.

21.2.2 Time Critical Situation

A malfunction during a critical phase of flight (i.e., requiring immediate action tasks by recall) should be positively announced by the observing crewmember. As time permits, the other crewmember should make every effort to confirm/identify the malfunction before initiating emergency action. On takeoff, for example, the PNF usually is the first to observe any indication of a critical failure. Upon observing such indication, the PNF announces it and simultaneously verifies the malfunction graphically to the PF (pointing to the indicator/annunciator).

On verification of malfunction, the PF announces his/her decision and commands accomplishment of recall action items, monitoring the PNF in those tasks accomplished by the PNF.

21.2.3 Emergency/Abnormal Procedures (Checklist Utilization)

Emergency situations requiring immediate corrective actions, identified in the respective checklist as memory or recall items, are accomplished without reference to the checklist. All other emergency and abnormal procedures should be accomplished by reference to the printed checklist; however, pilots are expected to be thoroughly familiar with each checklist procedure.

Emergency and abnormal checklists should be accomplished so that the pilot reading the checklist states both the CHALLENGE and the RESPONSE when the item has been accomplished. When a checklist procedure calls for the movement or manipulation of controls or switches critical to flight safety (e.g., power levers, propeller levers), the pilot performing the action obtains verification from the other pilot that he/she is moving the correct control or switch prior to initiating the action.

Any checklist action pertaining to a specific control switch or equipment that is duplicated in the cockpit is read to include its relative position stated left or right (e.g., right condition lever, left boost pump). The planned route of

flight may influence the designation of takeoff abort "trigger" malfunctions. When departing a coastal airport for a long overwater leg, for instance, a prudent course might be to abort the takeoff for any annunciated malfunction or for others in addition to those listed above. If such a preflight decision is made, it must be included in the before takeoff briefing.

21.2.4 Nonrecall Procedures

Recognition and verification of a malfunction or impending malfunction during noncritical phases of flight require the same positive verbal and graphic communication; however, time is not as critical and allows more deliberated and positive consensus of the malfunction. Corrective action always is accomplished utilizing the appropriate checklist.

21.2.5 Sterile Cockpit

A sterile cockpit is a concept whereby cockpit activity and communications below 10,000 feet Mean Sea Level (MSL) should relate to the tasks at hand. Nonessential and potentially distracting conversations in this critical phase of flight should be avoided. A sterile cockpit is not meant to preclude normal cockpit interaction below 10,000 feet MSL.

21.3 CREW RESPONSIBILITIES

21.3.1 Transport Plane Commander (TPC)

The TPC shall be in command of the aircraft and is responsible for the safe and orderly conduct of the flight. His/her responsibility exists from the time he/she accepts the flight and the crew has reported to him/her for such flight until the flight is completed and/or he/she is relieved from duty by proper authority. The authority and responsibility of the transport plane commander for the flight are independent of the presence of other persons senior to him/her in the crew or among the passengers except as stated in Article 0823 U.S. Navy Regulations, herein quoted in part: "The Commanding Officer of a ship or aircraft, not a flagship with a flag officer eligible for command at sea embarked as a passenger by due authority, shall be subject to the orders of such flag officer; other officers embarked as passengers, senior to the Commanding Officer, shall have no authority over him."

The TPC will be thoroughly familiar with this manual, squadron manuals and directives, and all other pertinent directives from higher authority.

At the discretion of the transport plane commander, the crew duties and responsibilities outlined in the following paragraphs may be reassigned as appropriate within the crew. The transport plane commander has the authority to delay or discontinue a flight when, in his/her opinion, conditions are unsafe starting or continuing a flight.

21.3.2 Copilot

The copilot is second in command and is responsible for assisting the TPC in the performance of his/her duties and such other duties as may be assigned. When an NFO-QO is assigned as copilot, his/her duties are the same as listed below except he/she shall not assume physical control of the aircraft.

The copilot may control the aircraft without special weather restrictions and may make instrument climbs, descents, landings, and takeoffs, day or night, consistent with his/her instrument qualifications.

The TPC shall use his/her discretion in each case of adverse weather or emergencies encountered when deciding if the copilot is capable of executing a safe departure or approach.

When in control of the aircraft, in the absence of the TPC from the cockpit, the copilot shall make sure the safe conduct of the flight and shall notify the TPC immediately of any unusual events or circumstances.

In the event of disability of the TPC during flight, the copilot with the highest designation shall take command of the flight and assume the authority, duties, and responsibilities of the TPC to the next enroute station or to a closer alternate, as the situation warrants.

The copilot shall constantly monitor all maneuvers being performed by the pilot, bringing to his/her attention any deviations from normal operations. When, in his/her opinion, the flight is bordering on unsafe conditions, it is the copilots responsibility to prompt the pilot, regardless of designation or rank.

21.3.3 Transport Aircrewman

The transport aircrewman shall:

- 1. Verify the fuel load and obtain any special instructions from the transport plane commander before flight.
- 2. Prepare a DD 365-4 (Form F).
- 3. Provision the aircraft with water, coffee, box lunches, etc., as required.
- 4. Configure aircraft for appropriate load. Load and secure cargo and/or passengers.
- 5. Give normal and emergency instructions to the passengers in accordance with paragraph 7.2.3.
- 6. Make sure passenger comfort during flight.
- 7. Maintain cleanliness within the aircraft during flight.
- 8. Prepare manifest, customs forms, etc.
- 9. Ensure aircraft is properly secured after flight, including chocks, tiedowns, propeller restraints, pitot covers, and intake covers as appropriate.

In the event a transport aircrewman is not assigned, the copilot will assume duties at the discretion of the transport plane commander.

21.4 SPECIFIC RESPONSIBILITIES

21.4.1 Flightcrew

This section provides for mandatory briefs, duties, and voice calls to be made during a specified flight phase. Development of good cockpit resource management shall be the goal of all UC-12W aircrew. Briefs should be succinct. The following recommendations are outlines that should be used to ensure successful completion of the mission. Additional items may be employed to brief the crew at the discretion of the TPC.

21.4.2 General

Prior to conducting a flight, the TPC shall ensure the following responsibilities and procedures are understood.

21.4.2.1 Pilot Flying

The PF shall:

- 1. Fly the aircraft.
- 2. Call for checklists.
- 3. Back up the PNF.

21.4.2.2 Pilot Not Flying

The PNF shall:

- 1. Read the checklists.
- 2. Assist the PF as required.
- 3. Communicate with ATC and record clearances.
- 4. Tune, ID, and set all radios and NAVAIDs.
- 5. Call 1,000 feet prior to assigned altitude.
- 6. Call airspeed deviations as required.

- 7. Call altitude deviations.
- 8. Call one dot deviation off course or glideslope.
- 9. Call abnormal pitch, roll, and sink rates.

21.4.3 Preflight

The TPC shall brief all aircrew on duties, route, weather, passengers, cargo load, and any unusual requirements or conditions.

21.4.4 Engine Start

Prior to engine start, the PF shall conduct a brief that includes the start sequence and procedures to be used.

21.4.5 Takeoff

The PF shall conduct a takeoff brief that shall include the following:

- 1. Voice callouts.
- 2. Abort criteria.
- 3. Emergency return.
- 4. Normal departure.

21.4.6 Departure

1. The climb checklist shall be called for above 1,000 feet AGL.

21.4.7 Approach

The PF shall conduct an approach brief that shall include the following:

- 1. Weather.
- 2. Airfield and runway.
- 3. Type of approach and landing.
- 4. Missed approach.
- 5. Voice callouts.

21.4.7.1 Instrument Approach

When conducting an instrument approach, the following items should be briefed:

- 1. Name of approach.
- 2. Automatic Terminal Information System (ATIS) information and current weather.
- 3. NAVAIDs and frequencies.
- 4. Minimum sector altitudes.
- 5. Inbound leg to FAF, procedure turn, and altitudes.
- 6. Final approach course and altitude.
- 7. Timing (as required).
- 8. DH, MDA, and Visual Descent Point (VDP).
- 9. Height above touchdown (set on radio altimeter).

- 10. Missed approach point.
- 11. Runway elevation, length, and width.
- 12. Terrain and obstacles near field.
- 13. Airfield lighting.
- 14. Calling field in sight.
- 15. Missed approach procedures.

21.5 STANDARD CALLOUTS

21.5.1 Checklist Request

SITUATION	PF	PNF
PF calls for checklist.	"CHECKLIST"	
After completion of checklist PNF will respond:		"CHECKLIST COMPLETE"

21.5.2 Takeoff

Figure 21-1. Takeoff

SITUATION	PF	PNF
PF advances power towards briefed T/O power.	SET POWER	
After PF advances Power, PNF adjusts torque within target range; scans engine instruments and advisory annunciators and if no abnormalities states:		"4 OR 6 OUT. 2 ON. ON THE GOVERNORS, POWER SET."
Airspeed begins to indicate on airspeed indicators.		"AIRSPEED ALIVE"
Passing through 80 knots PNF crosschecks airspeed on PFDs and standby indicators.		"80 KNOTS, CROSSCHECKED"
At V ₁ PNF calls V ₁ . After V ₁ call PF removes hand from power levers and places both hands on yoke.		"V ₁ "
At V _r PNF calls:		"ROTATE"
At V ₂ PNF calls:		"V ₂ "
When positive rate is indicated by altimeter and VSI, PNF calls:		"POSITIVE RATE"
After POSITIVE RATE call, PF calls "GEAR UP" and moves gear handle to UP position and landing/taxi lights to OFF.	"GEAR UP"	
At 200 feet AGL, PF calls:	"YAW DAMPER ON, FLIGHT LEVEL CHANGE, SET 135"	
At or above 400 feet AGL, PF calls:	"AUTOPILOT ON"	

Figure 21-1. Takeoff (cont.)

SITUATION	PF	PNF
PNF engages autopilot.		"AUTOPILOT ON"
At a minimum of 1,000 feet AGL or when conditions allow PF calls:	"CLIMB CHECKLIST"	

21.5.3 Flap/Gear Extension

Figure 21-2. Flap/Gear Extension

SITUATION	PF	PNF
When PF is ready for approach flaps call:	"APPROACH FLAPS"	
PNF checks speed and selects flaps to APPROACH.		"SPEED CHECKS"
PNF verifies that approach flaps are set.		"FLAPS APPROACH"
When PF is ready for gear extension calls:	"GEAR DOWN"	
PNF checks speed and call:		"SPEED CHECKS"
PF moves gear handle down EXT LTS MODE SW — As Required, turns landing/taxi lights to ON and calls:	"LANDING CHECKLIST"	
PF verifies gear down.	"DOWN THREE GREEN"	
PNF verifies positive indication of gear down.		"DOWN THREE GREEN"

21.5.4 Precision Approach

Figure 21-3. Precision Approach

SITUATION	PF	PNF
When LOC Course comes alive, either pilot may make this call.	"COURSE ALIVE"	"COURSE ALIVE"
When Glide Slope comes alive, either pilot may make this call.	"GLIDE SLOPE ALIVE"	"GLIDE SLOPE ALIVE"
At one dot below Glide Slope, PF calls:	"GEAR DOWN"	
PNF checks speed and call:		"SPEED CHECKS"
PF moves gear handle down, turns landing/taxi lights to ON and calls:	"LANDING CHECKLIST"	
PF verifies gear down.	"DOWN THREE GREEN"	
PNF verifies gear down.		"DOWN THREE GREEN"
At Glide Slope intercept PF calls:	"FLAPS DOWN"	
PNF checks speed and selects flaps DOWN.		"SPEED CHECKS"

Figure 21-3. Precision Approach (cont.)

SITUATION	PF	PNF
1,000 feet Above Field Level (AFL) on baro altimeter:		"ONE THOUSAND FEET STABILIZED"
500 feet above Decision Altitude (DA):		"FIVE HUNDRED ABOVE"
100 feet above Decision Altitude (DA):		"ONE HUNDRED ABOVE"
At	DA, Runway Environment Not In Sig	ht
If the PNF does not see the runway environment or approach lights at DA:		"DECISION ALTITUDE — GO AROUND"
At DA the PF shall execute go around procedures:	"GO AROUND, SET POWER"	
	Runway In Sight At Or Above DA	
At or above DA if the PNF sees the runway:		"RUNWAY IN SIGHT"
The PF will confirm that he has the runway in sight and he intents to land by calling:	"LANDING"	
At or above 200 feet once the PF disconnects the autopilot and yaw damper, PNF will call:		"LANDING CHECKLIST COMPLETE"
App	roach Lights In Sight At Or Above I	DA
At or above DA if the PNF sees the approach lights:		"APPROACH LIGHTS — CONTINUE"
At or above 200 feet once PF disconnects the autopilot and yaw damper, PNF will call:		"LANDING CHECKLIST COMPLETE"
At 100 feet TDZE or above if PNF sees the runway.		"RUNWAY IN SIGHT"
The PF will confirm that the runway in sight and that he intends to land by calling:	"LANDING"	
At 100 feet TDZE if the PF does not hear RUNWAY IN SIGHT call he/she will execute go around procedures:	"GO AROUND, SET POWER"	

21.5.5 Non-Precision Approach

Figure 21-4. Non-Precision Approach

SITUATION	PF	PNF
When CDI or ADF comes alive, either pilot may make this call:	"COURSE ALIVE"	"COURSE ALIVE"
Final approach course inbound and prior to the FAF, PF calls:	"GEAR DOWN"	
PNF checks speed and call:		"SPEED CHECKS"

Figure 21-4. Non-Precision Approach (cont.)

SITUATION	PF	PNF
PF moves gear handle down, turns landing/taxi lights to ON, and calls:	"LANDING CHECKLIST"	
PF verifies gear down.	"DOWN THREE GREEN"	
PNF verifies gear down.		"DOWN THREE GREEN"
Final Approach Fix:		"FAF INBOUND"
Crossing FAF:	"START TIME"	
When PF is ready for flaps DOWN calls:	"FLAPS DOWN"	
PNF checks speed and selects flaps DOWN.		"SPEED CHECKS"
1,000 feet AFL on baro altimeter:		"ONE THOUSAND FEET STABILIZED"
500 feet above minimums:		"FIVE HUNDRED ABOVE"
100 feet above mins:		"ONE HUNDRED ABOVE"
At the MDA PF calls:	"MINIMUMS"	
If the PNF does not have the approach lights or runway environment in sight when the		"CONTINUE X.X SECONDS TO MISSED APROACH POINT"
PF makes the minimums, PNF		or
responds with:		"CONTINUE X.X MILES TO MISSED APROACH POINT"
If PNF sees the approach lights he calls for PF to continue the		"CONTINUE APPROACH LIGHTS IN SIGHT"
approach. If PNF sees the runway environment, he calls for PF to		or
transition to an outside scan:		"GO VISUAL RUNWAY AT
		O'CLOCK"
The PF will confirm that the runway is in sight and that he intends to land by calling:	"LANDING"	
At MAP If the PNF does not have the approach lights or the runway environment in sight, PNF calls:		"MISSED APPROACH POINT"
If PNF calls MISSED APPROACH POINT, PF shall execute a missed approach and call:	"GO AROUND, SET POWER"	

21.5.6 Visual Approach

Figure 21-5. Visual Approach

SITUATION	PF	PNF
At 500 feet AFL on the baro altimeter.		"FIVE HUNDRED FEET"

21.5.7 New Altimeter Setting

Figure 21-6. New Altimeter Setting

SITUATION	PF	PNF
New altimeter setting received and set both PF and PNF.	"XX.XX, SET AND CROSSCHECKED"	"XX.XX, SET AND CROSSCHECKED"

21.5.8 New Altitude Assigned

Figure 21-7. New Altitude Assigned

SITUATION	PF	PNF
ATC issues new altitude, PNF sets new altitude in the altitude alerter and states:		"FL THREE TWO ZERO" or if below transition level "ONE SEVEN THOUSAND"
PF verifies the altitude set in altitude alerter and states:	"FL THREE TWO ZERO" or if below transition level "ONE SEVEN THOUSAND"	

21.5.9 Approaching Assigned Altitude

Figure 21-8. Approaching Assigned Altitude

SITUATION	PF	PNF
1,000 feet prior.		"SEVEN THOUSAND FOR EIGHT THOUSAND"
		or
		"ONE THOUSAND TO GO"
PF verifies the altitude and calls:	"SEVEN THOUSAND FOR EIGHT THOUSAND"	
	or	
	"ONE THOUSAND TO GO"	

21.5.10 Maximum Power Required

Figure 21-9. Maximum Power Required

SITUATION	PF	PNF
PF will advance power levers full forward.	"MAX POWER"	
PNF verifies power levers are full forward.		"MAX POWER SET"

21.5.11 TCAS Resolution Advisory (RA) Maneuver

Figure 21-10. TCAS Resolution Advisory (RA) Maneuver

SITUATION	PF	PNF
Aural and/or visual RA command issued by TCAS.	"CLIMBING" or "DESCENDING"	
PNF verifies and monitors PF response to RA and as soon as practical notifies ATC.		"XYZ CENTER, EASY 27 TCAS CLIMB (OR DESCENT)"

21.5.12 Missed Approach/Go-Around

Figure 21-11. Missed Approach/Go-Around

SITUATION	PF	PNF
The decision to GO-AROUND can be made by either the PF or PNF. If the PNF calls for a Go-Around, the PF will repeat GO-AROUND and begin the procedure.		"GO-AROUND"
PF presses the GO-AROUND button and calls:	"GO AROUND, SET POWER"	
The PF will advance the power levers forward toward maximum power and then move hands back to yoke simultaneously pitching the aircraft 10 degrees nose up using the flight director go-around mode. PNF adjusts power levers to maximum.		"POWER SET"
Comply with MISSED APPROACH/GO-AROUND procedures.		

21.6 TRAINING CALLOUTS

21.6.1 Approach to Stall Recovery — Landing Configuration

Figure 21-12. Approach to Stall Recovery — Landing Configuration

SITUATION	PF	INSTRUCTOR
If the PF does not attempt recovery at the first indication of stall, the instructor pilot will announce:		"RECOVER"
At the first indication of stall to include: – Stall warning horn	"SET POWER"	
Charted stall speed		
– Airframe buffet		
 Loss of Control Effectiveness 		
– Excessive Sink Rate		
PF will announce and simultaneously advance the power levers toward maximum power and lower nose attitude to stop the stall warning horn. Ensure wings are level during recovery.		
IP adjusts power levers to maximum. PF visually verifies that climb power is set.		"POWER SET"
PF climbs out at V_{REF} until base altitude, then begins acceleration.		
A V _{REF} +10 IP says:		"V _{REF} PLUS TEN"
PF will maintain airspeed of V _{REF} +10 or greater and climb to the reference or base altitude if low.	"FLAPS APPROACH"	
IP sets and verifies that flaps are in approach.		"FLAPS APPROACH"
When positive rate is indicated by altimeter and VSI, IP calls:		"POSITIVE RATE"
After POSITIVE RATE call, PF calls GEAR UP and moves gear handle to UP position and landing/taxi lights to OFF.	"GEAR UP"	
At a minimum of V _{YSE} (BLUE LINE), IP states:		"BLUE LINE"
After the BLUE LINE call, PF calls:	"FLAPS UP"	
IP selects flaps UP position and after verifying flaps in the UP calls:		"FLAPS UP"

21.6.2 Approach to Stall Recovery — Takeoff Configuration

Figure 21-13. Approach to Stall Recovery — Takeoff Configuration

SITUATION	PF	INSTRUCTOR
If the PF does not attempt recovery at the first indication of stall, the Instructor Pilot (IP) will announce:		"RECOVER"
At the first indication of stall to include: – Stall warning horn	"SET POWER"	
- Charted stall speed		
 Airframe buffet 		
 Loss of control effectiveness 		
 Excessive sink rate 		
PF will simultaneously advance the power levers toward maximum power and lower the nose attitude to stop the stall warning horn. Ensure that the wings are level during the recovery.		
IP adjust power levers to maximum.		"POWER SET"
PF visually verifies that climb power is set and climbs to reference or base altitude if low. At a minimum of V _{YSE} (BLUE LINE) IP states:		"BLUE LINE"
After the BLUE LINE call, PF calls:	"FLAPS UP"	
IP selects flaps UP position and after verifying that flaps are UP calls:		"FLAPS UP"

21.6.3 Approach to Stall Recovery — Clean Configuration

Figure 21-14. Approach to Stall Recovery — Clean Configuration

SITUATION	PF	INSTRUCTOR
If the PF does not attempt recovery at the first indication of stall, the Instructor Pilot (IP) will announce:		"RECOVER"
At the first indication of stall to include:	"SET POWER"	
 Stall warning horn 		
 Charted stall speed 		
 Airframe buffet 		
 Loss of Control Effectiveness 		
 Excessive Sink Rate 		
PF will simultaneously advance the power levers toward maximum power and lower the nose attitude to stop the stall warning horn. Ensure that the wings are level during the recovery.		
IP adjust power levers to maximum power and calls.		"POWER SET"
PF will maintain airspeed and climb to reference or base altitude if low.		

PART X

NATOPS Evaluation

Chapter 22 — NATOPS Evaluation

CHAPTER 22

NATOPS Evaluation

22.1 CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating UC-12W aircraft. The NATOPS evaluation is intended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatibility with various operational commitments and missions for Marine Corps units. The prime objective of the NATOPS evaluation program is to assist the unit commanding officer in improving unit readiness and safety through constructive comment. Maximum benefit from the NATOPS program is achieved only through vigorous support of the program by commanding officers as well as flight crew members.

22.2 APPLICABILITY

The NATOPS evaluation shall be administered annually to TPCs, T2Ps, NFO-QOs and TAs.

22.3 DEFINITIONS

The following terms used throughout this chapter are defined as to their specific meaning within the NATOPS program:

- 1. NATOPS evaluation A periodic evaluation of individual flight crew member standardization consisting of an open-book examination, a closed-book examination, and a flight evaluation.
- 2. NATOPS reevaluation A partial NATOPS evaluation administered to a flight crew member who has been placed in an Unqualified status by receiving an Unqualified grade for any of his/her ground examinations or the flight evaluation. Only those areas in which an unsatisfactory level was noted need be observed during a reevaluation.
- 3. Minor discrepancies and/or omissions Minor discrepancies and/or omissions, as may be referred to in the grading criteria, are defined as those that would not adversely affect the successful completion of the mission or jeopardize the safety of the crew and/or equipment.
- 4. Momentary deviations Very brief deviations from the tolerances set forth in the grading criteria will not be considered in marking, provided the evaluee is alert in applying corrective action and the deviation does not jeopardize the safety of the aircraft or crew and does not exceed the limitations prescribed for the Conditionally Qualified grade. Cumulative momentary deviations, however, will result in downgrading.
- 5. Qualified (Q) That degree of standardization demonstrated by a very reliable flight crew member who has a good knowledge of standard operating procedures and a thorough understanding of aircraft capabilities and limitations.
- 6. Conditionally Qualified (CQ) That degree of standardization demonstrated by a flight crew member who meets the minimum acceptable standards. He/she is considered safe enough to fly as an Aircraft Commander or to perform normal duties without supervision, but more practice is needed to become Qualified.
- 7. Unqualified (U) That degree of standardization demonstrated by a flight crew member who fails to meet minimum acceptable criteria. He/she should receive supervised instruction until he/she has achieved a grade of Qualified or Conditionally Qualified.
- 8. Area A routine of preflight, flight, or postflight.
- 9. Subarea A performance subdivision within an area that is observed and evaluated during an evaluation flight.

- 10. Critical Area Any area or subarea that covers items of significant importance to the overall mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.
- 11. Emergency An aircraft component system failure or condition that requires instantaneous recognition, analysis, and proper action.
- 12. Malfunction An aircraft component or system failure or condition that requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

22.4 IMPLEMENTATION

The NATOPS evaluation program shall be carried out in every unit operating naval aircraft. The various categories of flight crew members desiring to attain/retain qualifications in the UC-12W shall be evaluated in accordance with the current CNAF M-3710.7. Individual and unit NATOPS evaluations will be conducted periodically; however, instruction in the observation of adherence to NATOPS procedures will be on a daily basis within each unit to obtain maximum benefits from the program. The NATOPS coordinators, evaluators, and instructors shall administer the program as outlined in the current CNAF M-3710.7. Evaluees who receive a grade of Unqualified on a ground or flight evaluation shall be allowed 30 days in which to complete a reevaluation. A maximum of 60 days may elapse between the date the initial ground evaluation was commenced and the date the flight evaluation is satisfactorily completed.

22.5 GROUND EVALUATION

Prior to commencing the flight evaluation, an evaluee must achieve a grade of Qualified on the open- and closed-book examinations. The oral examination is also part of the ground evaluation but may be conducted as part of the flight evaluation. To ensure a degree of standardization between units, the NATOPS instructors may use the bank of questions contained in this chapter in preparing portions of the written examinations.

22.5.1 Open-Book Examination

Up to 50 percent of the questions used may be taken from the question bank. The number of questions on the examination will not exceed 40 or be fewer than 20. The purpose of the open-book examination portion of the written examination is to evaluate pilot knowledge of appropriate publications and the aircraft.

22.5.2 Closed-Book Examination

Up to 50 percent of the closed-book examination may be taken from the question bank and shall include questions concerning normal procedures, emergency procedures, and aircraft limitations. The number of questions on the examination will not exceed 40 or be fewer than 20. Questions designated critical will be so marked. An incorrect answer to any question in the critical category will result in a grade of Unqualified being assigned to the examination.

22.5.3 Oral Examination

The questions may be taken from this manual and drawn from the experience of the instructor/evaluator. Such questions should be direct and positive and should in no way be opinionated.

22.5.4 Grading Instructions

Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of Qualified or Unqualified.

22.5.4.1 Open-Book Examination

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.5.

22.5.4.2 Closed-Book Examination

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.3.

22.5.4.3 Oral Examination

A grade of Qualified or Unqualified shall be assigned by the instructor/evaluator.

22.6 FLIGHT EVALUATION

The flight evaluation is designed to measure with maximum objectivity the degree of standardization demonstrated by pilots and crew members. It is not intended to measure the proficiency and/or ability of those evaluated beyond a point necessary to ensure safety of flight. Within reasonable limits, any individual evaluated should be able to attain a Qualified grade based upon demonstrated knowledge without regard to special proficiency or ability.

Note

All critical items must be covered on all checkflights. Other items may be covered at the discretion of the evaluator.

The process uses three integrated parts: the NATOPS Evaluation Worksheet OPNAV Form 3710/11 flight evaluation criteria (paragraphs 22.7, 22.8, or 22.9), and the NATOPS Evaluation Report OPNAV Form 3710/7. The flight evaluation worksheet is designed to enable the instructor/evaluator to record pertinent information for the purpose of a comprehensive postflight reconstruction and critique. Following completion of the evaluation, data from the worksheet is compared with the grading criteria to determine the numerical/adjectival equivalent for entry on the evaluation report form.

22.6.1 Flight Evaluation Grade Determination

22.6.1.1 Flight Evaluation Grading Criteria

Only those subareas observed or required will be graded. The grade assigned for a subarea shall be determined by comparing the degree of adherence to standard operating procedures with adjectival ratings listed below. Momentary deviations from standard operating procedures should not be considered as unqualifying, provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action.

The following procedure shall be used in determining the flight evaluation grade. A grade of Unqualified in any critical area/subarea will result in an overall grade of Unqualified for the flight. Otherwise, flight evaluation (or area) grades shall be determined by assigning the following numerical evaluation to the objective grade of each subarea. Only the following numerals 0, 2, or 4 will be assigned to subareas without interpolation:

Unqualified — 0.0.

Conditionally Qualified — 2.0.

Qualified — 4.0.

To determine the numerical grade for an area and the overall grade for the flight, add all the points assigned to the subareas and divide this sum by the number of subareas graded. The objective grade shall then be determined on the basis of the following scale:

0.0 to 2.10 — Unqualified.

3.0 to 4.0 — Qualified.

2.2 to 2.99 — Conditionally Qualified.

22.6.1.2 Final Grade Determination

The final NATOPS evaluation grade shall be the same as the grade assigned to the evaluation flight. An evaluee who receives an unqualified on any ground examination or the flight evaluation shall be placed in an Unqualified status until he/she achieves a grade of Conditionally Qualified on a reevaluation.

Note

Asterisked (*) areas and subareas are critical.

22.6.1.3 Critique

The critique is the terminal point in the NATOPS evaluation and will be given by the instructor/evaluator administering the check. The critique involves processing data collected and oral presentation of the Evaluation Worksheet. Deviations from standard operating procedures will be covered in detail, using all collected data and the Evaluation Worksheet.

22.6.1.4 Records and Reports

A NATOPS evaluation worksheet (OPNAV Form 3710/11) shall be completed for each evaluation. This report shall be filed in the individual flight training record and retained therein.

22.7 PILOT NATOPS EVALUATION GRADING CRITERIA

22.7.1 Preflight

1. Flight planning:

Qualified — Properly prepared for the assigned flight. Familiar with all aspects pertinent to the flight proposed, including en route instrument publications. Had prepared all the necessary flight logs, forms, etc., as appropriate to ensure successful completion of the flight.

Conditionally Qualified — Limited preparation made for assigned flight. Certain important aspects lacking to ensure the total success of the flight. Flight planning, however, would not jeopardize the safe conduct of the flight.

Unqualified — Failed to meet the minimum standards of Conditionally Qualified.

2. Crew/passenger briefing:

Qualified — Conducted a thorough, detailed, and professional briefing for the crew and/or passengers, covering route, altitude, destination, weather factors, use of personal and emergency equipment, emergency procedures, smoking privileges, etc., in accordance with current directives.

Unqualified — Conducted no briefing or failed to cover emergency procedures to the extent necessary to ensure effective action during emergencies.

3. Aircraft inspection:

Qualified — Ensured thorough aircraft inspection. Inspected data sheets of previous discrepancies and preflight inspection form.

Conditionally Qualified — Completed aircraft inspection with omissions in minor areas that did not affect the safety of the proposed flight. Did not check previous discrepancy sheets.

Unqualified — Failed to conduct aircraft inspection properly and omitted important items that affected the safety of the proposed flight. Overlooked equipment adrift in the aircraft.

4. Pilot safety and survival equipment:

Qualified — Safety and survival equipment complete. Demonstrated thorough knowledge and utilization of required equipment.

Unqualified — Any omission of safety or survival equipment that would preclude a successful ditching or jeopardize safety or survival. Unfamiliar with the use of required equipment, lack of knowledge of fire extinguishers, oxygen equipment, aircraft exits, liferafts, or other pertinent equipment.

22.7.2 Pretakeoff

1. Prestart:

Qualified — Executed NATOPS checklist properly. Demonstrated a thorough knowledge of all items.

Conditionally Qualified — Completed checklist satisfactorily. Minor omissions that did not jeopardize flight or system operation. Adequate understanding of all items.

Unqualified — Failed to complete checklist properly, thereby affecting safe flight operations. Knowledge of items not adequate to ensure safe and successful operation.

2. Start:

Qualified — Knew limitations and ensured execution of proper procedures.

Conditionally Qualified — Adequate knowledge of limitations and procedures or slow to recognize a start malfunction.

Unqualified — Did not know limitations or did not follow standard start procedure.

3. Taxi procedures:

Qualified — Procedures required by the NATOPS flight manual complied with. Taxi signalmen were utilized, power and speeds regulated closely, all lights and taxi aids were utilized as necessary. Checklists were accomplished without omission or discrepancy. Judicious use of power levers.

Conditionally Qualified — Procedures required by the NATOPS flight manual accomplished with omissions, deviations, or discrepancies that did not adversely affect successful completion of the mission, jeopardize safety, or cause undue delay.

Unqualified — Any omission or discrepancy that precluded successful completion of the mission, jeopardized safety, or caused excessive delay. Excessive use of reverse in areas of loose dirt or stones.

4. Before Takeoff:

Qualified — Executed checklists properly. Make sure deicing, anti-icing, and engine checks completed without omissions and in proper sequence. Set up radios in accordance with those facilities needed for initial climbout and on-course navigation. Checked all communication/navigation equipment in accordance with the best means available. Operated equipment in accordance with appropriate directives. Fully utilized available radios and NAVAIDs. Conducted proper briefing for the takeoff.

Conditionally Qualified — Completed all of above, but with minor discrepancies or omissions or not in proper sequence.

Unqualified — Failed to satisfy Conditionally Qualified or any item jeopardizing safe operation.

22.7.3 Takeoff, Climb, and Cruise

1. Normal takeoff:

Qualified — Aircraft aligned with runway, initial power application smooth, directional control maintained with nosewheel until rudder effective and then with rudder.

Conditionally Qualified — Aircraft not aligned with runway, discrepancies in power applications. Abrupt or excessive usage of nosewheel steering. Discrepancies in any of the foregoing to an extent not jeopardizing safe operations.

Unqualified — Failed to satisfy Conditionally Qualified or any item jeopardizing safe operation.

2. Normal transition:

Qualified — Rotated aircraft smoothly within 0 to +5 knots of rotation speed. Maintained balanced flight and correct takeoff pitch attitude until power reduction. Gear retracted without delay after establishing positive rate of climb.

Conditionally Qualified — Nosewheel skip or nose-high takeoff. Rotation airspeed within 0 to +10 knots of rotation speed. Aircraft in unbalanced flight; did not maintain takeoff attitude until power reduction.

Unqualified — Poor handling technique after liftoff, positive rate of climb not established or maintained. Gear retracted prematurely. Any other failure to satisfy Conditionally Qualified or any item jeopardizing safe operations.

3. Malfunctions before liftoff:

Qualified — Used proper abort procedures. Maintained directional control and minimized swerve of aircraft. Announced intentions to abort the takeoff.

Conditionally Qualified — Slow in initiating correct abort procedures. Minor difficulty maintaining directional control of the aircraft, but not sufficient to jeopardize safety. Did not announce intentions to abort

Unqualified — Did not use proper abort procedures. Serious difficulty maintaining directional control after executing abort.

4. Malfunctions after liftoff:

Qualified — Correctly diagnosed malfunction and completed appropriate procedures while maintaining positive control of the aircraft.

Conditionally Qualified — Failed to meet the requirements for a grade of Qualified, but did not jeopardize safety. Did not maintain positive control of the aircraft.

Unqualified — Failed to satisfy Conditionally Qualified or any item jeopardizing safe operation.

5. Climb and departure:

Qualified — Proper use of Climb Checklist. Maintained correct climb power setting. Climb airspeed maintained within ± 5 knots. Prescribed headings within ± 5 . Did not exceed the limits of assigned departure altitudes and proper execution of the SID (when applicable).

Conditionally Qualified — Established, but did not maintain correct climb power setting. Climb airspeed maintained within ± 10 knots. Prescribed headings within 10.

Unqualified — Failed to complete Climb Checklist. Did not establish correct climb power. Failed to satisfy requirements listed under Conditionally Qualified.

6. Level-off and cruise:

Qualified — Appropriate power and altitude selection. Demonstrated knowledge of proper operation of anti-icing and deicing systems. Adequate knowledge of engine and airframe operating limitations and fuel management procedures. Leveled off and maintained assigned altitude within +100 feet. Prompt, correct altitude changes as required.

Conditionally Qualified — Incorrect procedures or questionable knowledge, but not considered to be of sufficient magnitude to jeopardize safe operation.

Unqualified — Failed to satisfy above requirements or any action or omission jeopardizing safety of flight. Leveled off or maintained assigned altitude in excess of ± 150 feet. Excessive delay in executing assigned altitude changes.

22.7.4 Landings

1. Normal landing pattern:

Qualified — Entered and flew traffic pattern in accordance with the appropriate governing directives. Proper execution of descent and Landing Checklists. Flew the traffic pattern within ± 100 feet altitude and ± 5 knots airspeed.

Conditionally Qualified — Entered and flew traffic pattern in accordance with appropriate directives, but with deviations that did not interfere with traffic or jeopardize safety. Late calling for or completing checklists. Flew traffic pattern within ± 150 feet altitude and ± 10 knots of airspeed.

Unqualified — Deviated from prescribed pattern and interfered with other traffic or jeopardized safety. Failed to complete checklists. Exceeded limits of Conditionally Qualified.

2. Normal approach:

Qualified — Established and executed pattern in accordance with NATOPS flight manual. Proper use of power. Landing Checklist completed. Airspeed ±5 knots.

Conditionally Qualified — Deviation in approach not sufficient to jeopardize safety. Excessive power changes or rough use. Held airspeeds within ± 10 knots. Landing Checklist completed.

Unqualified — Deviation in approach that interfered with normal traffic or other deviations that jeopardized flight safety. Airspeed not held within above limits. Safe completion of approach was questionable and pilot did not attempt waveoff. Failed to complete Landing Checklist.

3. Normal landings:

Qualified — Maintained positive control of speed, power, and rate of descent. Aircraft aligned within runway limits throughout final approach. Maintained aircraft in trim. Nose-high touchdown in first third of runway. Maintained directional control during rollout. Positive control of reverse. Smooth, effective use of brakes and nosewheel steering.

Conditionally Qualified — Had minor difficulty with transition. Handled aircraft roughly and used poor technique in flare, landing, or rollout. Flat touchdown in first third of runway.

Unqualified — Had serious difficulty with transition. Failed to maintain positive control of aircraft during flare, landing, or rollout. Did not touch down in first third of runway. Hard landing. Jeopardized safety.

4. Single-engine approach:

Qualified — Normal airspeeds within ±5 knots (not safe below 120 knots until landing assured). Maintained trim and balanced flight. Checklists properly utilized and copilot briefed.

Conditionally Qualified — Deviations in approach in excess of Qualified that did not jeopardize safe completion. +10 and -5 knots, Landing Checklist completed.

Unqualified — Deviation in approach that interfered with normal traffic or other deviations that jeopardized flight safety. Safe completion of approach was questionable and pilot did not attempt waveoff. Failed to complete Landing Checklist.

5. Single-engine landing:

Qualified — Maintained positive control of speed, power, and rate of descent to touchdown. Nose-high touchdown in first third of runway. Maintained directional control through rollout. Smooth, effective use of brakes and nosewheel steering.

Conditionally Qualified — Had minor difficulty with transition. Handled aircraft roughly and used poor technique in flare, landing, or rollout. Hard or flat touchdown in first third of runway.

Unqualified — Had serious difficulty with transition. Failed to maintain positive control of aircraft during flare, landing, or rollout. Did not touch down in first third of runway. Jeopardized safety or otherwise failed to satisfy requirements of Conditionally Qualified.

6. No-flap approach:

Qualified — Same criteria as for a normal landing. Airspeed within ± 5 knots of prescribed. Landing Checklist completed.

Conditionally Qualified — Deviations in approach in excess of above, but did not jeopardize approach. Landing Checklist completed.

Unqualified — Deviation in approach that interfered with normal traffic or other deviations that jeopardized flight safety. Airspeed not held within above limits. Safe completion of approach was questionable and pilot did not attempt waveoff. Failed to complete Landing Checklist.

7. No-flap landing:

Qualified — Well-controlled, gradual power-on descent to landing. Proper trim. Touchdown in first third of runway. Well-controlled and proper use of reversing and brakes on rollout.

Conditionally Qualified — Excessive rate of descent or excessive flare on landing. Hard or flat touchdown in first third of runway. Rough usage or poor technique that did not jeopardize safety.

Unqualified — Failure to satisfy requirements of Conditionally Qualified.

8. Waveoff:

Qualified — Executed waveoff with proper use of power. Executed smooth transition to climb attitude, retracted gear, raised flaps, and established positive rate of climb. Maintained smooth acceleration to climb airspeed.

Unqualified — Slow or incomplete power application, failed to retract gear, raise flaps, or to achieve positive rate of climb. Followed incorrect sequence or utilized other unsafe actions.

22.7.5 Instrument Approach

1. Holding procedures:

Qualified — Entered holding in accordance with existing FAA requirements and used correct voice reports. Obtained expected approach or further clearance time. Maintained assigned holding pattern and altitude within ± 100 feet.

Conditionally Qualified — Entered holding pattern erratically. Failed to obtain expected approach or further clearance time. Varied pattern in excess of 30 seconds, altitude ± 200 feet.

Unqualified — Exceeded any requirement set forth under Conditionally Qualified.

2. Bearing interception:

Qualified — Demonstrated effective interception procedures by the most direct and acceptable methods. Understood the use of bearing equipment in establishing interception.

Conditionally Qualified — Effective bearing interception with some delay. Unsure of procedures and equipment, but performed interception without exceeding clearance limits.

Unqualified — Became disoriented. Experienced decided amount of difficulty in effecting interception. Failed to understand equipment and clearance limits.

3. Approach airspeed control:

Qualified — Maintained prescribed speed ranges and ±5 knots of specific airspeeds as published in NATOPS Flight Manual (Part III).

Conditionally Qualified — Maintained airspeeds within ± 10 knots of prescribed speed ranges.

Unqualified — Exceeded the preceding limits.

4. DME ARC:

Qualified — Maintained specified distance from station within ± 1 mile.

Conditionally Qualified — Maintained specified distance within ±2 miles.

Unqualified — Failed to meet the requirements for Conditionally Qualified.

5. Approach altitude control:

Qualified — Did not exceed limits of assigned or published altitudes. Maintained positive control of aircraft and situation during climb and descents.

Conditionally Qualified — Did not exceed limits of assigned or published altitudes. Had minor difficulty maintaining positive control of aircraft and situation during climbs and descents. Did not jeopardize safety of flight.

Unqualified — Exceeded the limits of assigned or published altitudes. Handled aircraft poorly. Did not maintain positive control of the situation.

6. Approach course control:

Qualified — Maintained course within ± 5 , effectively correcting for drift.

Conditionally Qualified — Maintained course within ± 10 . Had difficulty correcting for drift.

Unqualified — Failed to maintain course within ±10. Did not hold correction for drift.

7. Approach engine operation:

Qualified — Did not exceed maximum ITT or TORQUE.

Unqualified — Failed to observe ITT or TORQUE maximum.

8. Use of checklists:

Qualified — Properly used checklists, with no omissions or incorrect responses.

Conditionally Qualified — Late in calling for checklists, no serious omissions or incorrect responses.

Unqualified — Failed to use checklists, serious omissions or incorrect responses.

9. Missed approach:

Qualified — Prepared for missed approach. Timely and correct power application. Raised gear and flaps in accordance with waveoff procedure following power applications. Did not descend below minimums. No deviations from published procedures.

Conditionally Qualified — Not adequately prepared for missed approach. Incorrect power application. Improper sequence of power, flaps, and gear. Did not descend below minimums. Satisfactorily carried out published procedure.

Unqualified — Descended below minimums. Unsafe use of power. Unsatisfactory completion of published procedure.

10. Ground Control Approach (GCA)/ILS airspeed control:

Qualified — Maintained airspeeds within prescribed speed range and/or ±5 knots of specified airspeeds.

Conditionally Qualified — Maintained airspeeds within ±10 knots of prescribed speed.

Unqualified — Failed to remain within limits of Conditionally Qualified.

11. GCA/ILS altitude control:

Qualified — Leveled off and maintained assigned altitudes within ± 50 feet. Prompt, correct altitude changes.

Conditionally Qualified — Leveled off and maintained assigned altitudes within ± 100 feet. Delay in altitude changes.

Unqualified — Failure to remain within limits of Conditionally Qualified.

12. GCA/ILS heading/course control:

Qualified — Prompt response to heading instructions or course deviation; maintained assigned heading or course prior to final within ± 5 and on final within ± 3 ; balanced flight standard rate turns except during small heading changes.

Conditionally Qualified — Heading changes or course corrections late; maintained heading or course prior to final within ± 8 and on final within ± 5 ; unbalanced flight, turning rates excessively fast or slow.

Unqualified — Heading control not meeting requirements of Conditionally Qualified or resulting in waveoff or no gyro instructions.

13. GCA/ILS glideslope:

Qualified — Prompt and adequate glideslope corrections.

Conditionally Qualified — Maintained ILS glideslope within ± 1 dot deviation. Adjustments late or excessive, but deviations within scale.

Unqualified — Glideslope control inadequate or resulted in waveoff because of poor procedures.

14. GCA/ILS use of checklists:

Qualified — Prompt and timely completion of required checklists.

Conditionally Qualified — Delay or omissions in execution of checklists that did not affect safety of flight.

Unqualified — Delays or omissions in execution of checklists that affect safety of flight.

15. GCA/ILS missed approach:

Qualified — Properly carried out missed approach instructions. Power application, gear, flaps, and climb in accordance with NATOPS waveoff procedure.

Conditionally Qualified — Minor discrepancies in above not affecting safety of flight.

Unqualified — Not in conformance with the above.

22.7.6 Emergencies/Malfunctions

1. Aircraft handling:

Qualified — Maintained or established desired heading within ± 10 , altitude within ± 150 feet. Minimal airspeed loss. Raised flaps and gear if required.

Conditionally Qualified — Maintained or established desired heading within ± 20 , altitude within ± 200 feet. Excessive airspeed loss. Delayed gear and flap retraction if required. Did not jeopardize flight safety.

Unqualified — Failure to satisfy criteria for Conditionally Qualified, loss of control or orientation, unsafe airspeed loss, or other unsafe actions. Failed to raise flaps and gear if required.

2. Engine fire:

Qualified — Initiated first steps of checklist immediately and ensured remainder of checklist is accomplished.

Unqualified — Did not initiate or complete checklist. Performed any action detrimental to safety of flight.

3. Landing gear emergencies:

Qualified — Correctly demonstrated emergency landing gear extension and had an understanding of significance of pulling the landing gear circuit breaker. Had a knowledge of landing gear airspeed limitations.

Unqualified — Failed to execute proper procedures.

4. Brake malfunction:

Qualified — Promptly executed proper procedures and maintained positive control of aircraft.

Unqualified — Took excessive amount of time in stopping aircraft.

5. Loss of ac or dc power source:

Qualified — Correctly diagnosed malfunction and followed procedures in Part V.

Unqualified — Inadequate knowledge of system or procedures. Any action affecting safety of flight.

6. Electrical fire:

Qualified — Initiated first step of checklist if source unknown and ensured remainder of checklist was accomplished.

Unqualified — Did not initiate checklist and/or did not follow up on remainder of checklist. Failed to execute proper procedures.

7. Loss of pressurization:

Qualified — Correctly diagnosed cause of pressurization loss and took appropriate action.

Unqualified — Failed to recognize pressurization loss or take corrective action. Performed any action detrimental to safety of flight.

8. Emergency descent:

Qualified — Demonstrated knowledge and executed correct procedures.

Conditionally Qualified — Excessive delay in accomplishing emergency descent.

Unqualified — Inadequate knowledge of procedures. Other acts that resulted in unsafe operation.

9. Icing system malfunction:

Qualified — Correctly diagnosed malfunction and followed procedures outlined in Part V.

Conditionally Qualified — Correctly diagnosed malfunction, but made minor procedural errors that did not jeopardize safety.

Unqualified — Incorrectly diagnosed malfunction or made errors affecting safety of flight.

10. Ditching drill:

Qualified — Promptly and correctly assessed wind, sea, weather, and aircraft conditions. Maintained positive control of the aircraft and crew throughout the emergency. Executed proper procedures and accomplished the simulated water entry in such a way as to make successful ditching probable.

Conditionally Qualified — Minor omissions or errors in judgment that did not jeopardize the probability of crew survival.

Unqualified — Excessive rate of descent, slow airspeed, excessively fast airspeed, or improper flap setting or water entry speed. Other deficiencies or procedural omissions that would jeopardize the probability of crew survival.

11. Propeller malfunction:

Qualified — Demonstrated knowledge of procedures to follow with overspeeding propeller. Knowledge of protective devices in propeller autofeather and primary and overspeed governors.

Conditionally Qualified — Minor discrepancies in procedures. Knowledge of backup systems weak.

Unqualified — Did not know procedures to be followed with overspeeding propeller. Knowledge of protective systems limited to extent that safe operating procedures are jeopardized.

12. Airstart procedures:

Qualified — Properly executed starter-assisted and/or windmilling airstart procedures without exceeding engine or airframe limitations. Correctly executed procedures in outline in Part V.

Unqualified — Any procedure causing a hazard to aircraft or safety of flight. Did not execute correct airstart procedures.

13. Flight control malfunction:

Qualified — Correctly diagnosed malfunction and followed procedures in accordance with Part V.

Conditionally Qualified — Correctly diagnosed malfunction. Made minor errors following procedures outlined in Part V that did not jeopardize safety.

Unqualified — Incorrectly diagnosed malfunction or made errors that affected safety of flight.

22.7.7 Postflight Procedures

Qualified — Handled aircraft safely. Executed checklists. Taxied and parked aircraft in a safe manner. Completed all safety items without omissions.

Conditionally Qualified — Poor handling technique, failed to complete checklists, and allowed minor omissions in securing aircraft. Completed all safety items without omissions.

Unqualified — Handled aircraft in a hazardous manner, failed to request checklists. Any act, performance, or omission that could result in an unsafe condition.

22.8 TRANSPORT AIRCREWMAN NATOPS EVALUATION GRADING CRITERIA

22.8.1 Flight Planning and Preparation

1. Professional equipment:

Qualified — Had all necessary personal and professional equipment. Displayed positive knowledge of the proper use, care, and operation of such equipment.

Conditionally Qualified — Marginal knowledge of the proper use, care, and operation of personal and professional equipment.

Unqualified — Did not have required personal or professional equipment. The lack of this gear and proper knowledge of its use could cause compromise of safe operation. Successful survival in an emergency was doubtful.

2. Preflight inspection duties:

Qualified — Reported sufficiently in advance of flight to complete preflight inspection/duties, precluding delay of flight. Completed thorough preflight inspection in compliance with standard forms. Ascertained that all required equipment was aboard.

Conditionally Qualified — Completed aircraft inspection/duties with omission in minor areas that did not cause delay or affect the safety of the proposed flight.

Unqualified — Failed to conduct proper aircraft inspection and/or omitted important items that would affect the safety of flight. Failed to have all required equipment on board.

3. Preflight inspection paperwork:

Qualified — Accomplished all necessary paperwork.

Conditionally Qualified — Completed necessary paperwork, but with minor deviations from established procedures.

Unqualified — Did not accomplish required paperwork.

22.8.2 Preflight

1. Aircraft servicing:

Qualified — Displayed positive knowledge of requirements and proficiency in servicing of engine oil, fuel, oxygen, and hydraulic system components as outlined in approved manual and directives. All safety precautions were heeded.

Conditionally Qualified — Servicing of oxygen, engine oil, fuel, and hydraulic system components was accomplished with minor deviations of approved manuals and directives. Deviations did not compromise safety.

Unqualified — Servicing of engine oil, fuel, oxygen, and hydraulic system components was not accomplished in an approved manner. Safety precautions were partially or completely disregarded, thereby endangering aircraft and/or personnel.

2. Make sure all survival and flight attendant equipment aboard:

Qualified — Inspected aircraft to ensure adequate survival and flight attendant equipment aboard to accomplish mission. Knew procedures to procure additional equipment.

Conditionally Qualified — Completed inspection with minor omissions not affecting safety of flight.

Unqualified — Failed to ensure adequate survival equipment was aboard to accomplish mission.

3. Knowledge of weight and balance:

Qualified — Properly completed weight and balance clearance Form F (DD 365-4) to ensure aircraft was within allowable operating limits.

Unqualified — Made errors in computations, resulting in improper cabin load or exceeding allowable limits of aircraft.

4. Baggage handling:

Qualified — Loaded passenger baggage in proper sequence according to offloading points. Made sure proper stowage and securing of baggage in designated compartments.

Unqualified — Exceeded weight limits of compartments. Unnecessarily rough in handling.

5. Cargo loading and tiedown:

Qualified — Loaded aircraft within allowable cabin load or compartment limits.

Unqualified — Exceeded allowable cabin load or compartment limits. Failed to load within allowable cg limits. Failed to apply proper restraint to cargo.

6. Briefing:

Qualified — Briefed the passengers completely concerning the use of seatbelts, the observance of the no smoking and seatbelt signs, the availability of coffee and water aboard, safety regulations, and ditching procedures.

Conditionally Qualified — Same as Qualified, but omitted some items or incompletely briefed on any one item.

Unqualified — Gave incomplete briefing. Omitted most items that should have been covered.

22.8.3 Flight

1. Care of passengers:

Qualified — Courteous in meeting the needs and requests of passengers. Conformed to high standards of personal service and passenger comfort at all times. Anticipated needs and took initiative to convenience. Ensured that all requirements and requests were handled expeditiously and correctly. Consistently polite and attentive in dealing with passengers, assisting them whenever possible.

Conditionally Qualified — Possessed all the attributes of Qualified, but with occasional minor oversights.

Unqualified — Impolite in dealing with passengers. Lacked initiative in assisting passengers and failed to comply with requests. Disregarded standards of comfort desired and required for passengers.

2. In-flight emergency procedures:

Qualified — Exhibited complete understanding of the corrective actions required for various in-flight emergencies. Knew the emergency checklist thoroughly. On drills, conducted corrective measures in a highly professional manner.

Unqualified — Unsatisfactory knowledge of emergency procedures or corrective actions required. Attempted to perform an unsafe action during emergency drill conducted by the aircraft commander.

3. Ditching:

Qualified — Demonstrated a thorough knowledge of ditching procedures. Explained, in detail, all actions required for ditching in the proper sequence. Was able to execute the ditching expeditiously, safely, and correctly, requiring a minimum of supervision.

Unqualified — Did not know ditching procedures or left doubt that he/she would survive ditching or bailout if left to his/her own devices.

4. Care and use of equipment:

Qualified — Demonstrated correct use of all equipment applicable to his/her duties. Took care not to abuse or misuse equipment.

Conditionally Qualified — Same as Qualified, but could be more careful in handling of equipment.

Unqualified — Inadequate knowledge or improper utilization of equipment.

5. Location and use of survival equipment:

Qualified — Demonstrated a complete knowledge of all survival equipment normally carried in the aircraft, its use, care, and stowage locations. Thorough knowledge of how and when to launch, properly inflate, and board rafts.

Unqualified — Demonstrated lack of knowledge of survival equipment.

6. Forms used

Qualified — Completed all required forms expeditiously and accurately. Specifically checked passenger/cargo manifests and completed flight summary for given leg of the flight. All required forms for specific stations completed prior to arrival.

Conditionally Qualified — Completed all required forms but with minor omissions that did not adversely affect the flight.

Unqualified — Failed to satisfactorily complete necessary forms.

7. Aircraft cleanliness:

Qualified — Maintained a maximum standard of cleanliness and neatness at all times. Ensured that the cabin was cleaned thoroughly at regular intervals and that all waste receptacles were serviced at each stop en route. Displayed initiative in maintaining a high degree of aircraft cleanliness at all times.

Conditionally Qualified — Same as Qualified, but with minor deviations.

Unqualified — Neglected to empty waste receptacles at en route stops. Lack of concern and effort to keep the cabin spaces neat and clean. Failure to inspect the aircraft for cleanliness, or to correct discrepancies that exist.

22.8.4 Postflight

1. Servicing and securing:

Qualified — Displayed professional knowledge of requirements and proficiency in refueling and securing aircraft. All requirements, as outlined in approved manuals and directives, were accomplished in a professional manner. All safety precautions were heeded.

Conditionally Qualified — Refueling and securing were accomplished in accordance with approved manual and directives, but with minor deviations. Deviations did not compromise safety. Aircraft considered not completely secured, but not endangered.

Unqualified — Refueling and securing were not accomplished or were not accomplished in approved manner. Safety precautions were partially or completely disregarded, thereby endangering aircraft and/or personnel. Required supervision and/or further instruction.

2. Offloading procedure:

Qualified — Observed safe practices in cargo handling. Made sure compliance with load limits of aircraft and cargo handling equipment. Provided proper safeguards where appropriate.

Conditionally Qualified — Same as Qualified except for minor deviations.

Unqualified — Used unsafe procedure in offloading. Exceeded allowable limits of aircraft or equipment. Failed to provide proper safeguards.

3. Aircraft secured as required:

Qualified — Made sure aircraft entry doors and hatches were secured.

Conditionally Qualified — Same as Qualified except for minor deviations.

Unqualified — Made little effort to make sure aircraft was properly secured.

4. Security compliance:

Qualified — Made sure compliance with security regulations concerning special mail and/or cargo.

Conditionally Qualified — Same as Qualified except for minor deviations.

Unqualified — Failed to provide proper security as required.

5. Crew coordination:

Qualified — Coordinated action/requirements smoothly and effectively with all crewmembers. Anticipated demands upon crew position. The overall performance of the crew was enhanced by his/her critical decisions to the needs of others in the performance of their assigned duties.

Conditionally Qualified — Attempted to coordinate action/requirements, but lacked the desired effect. Intercommunication discipline at times interfered with crew. Responses to checklist were made with only minor deviations. Did not jeopardize mission.

Unqualified — Displayed undesirable traits related to crew coordination. Intercommunication discipline was nonexistent. Responses to checklist were vague or improper. Performance impaired the smooth accomplishment of the mission.

6. Knowledge of aircraft:

Qualified — Possessed a complete knowledge of the equipment and systems of the aircraft related to the performance of duties and execution of emergency procedures. Demonstrated the ability to properly operate all related equipment in an efficient manner. Knew the various aircraft configurations and understood the limitations and procedures involved in each case.

Conditionally Qualified — Displayed a general knowledge of equipment and systems related to performance of duties. Needs instruction and training in different configurations and related equipment.

Unqualified — Unfamiliar with necessary systems and equipment. Lacked knowledge of limitations or operation of equipment essential to performance of duties and/or safety.

7. Military courtesy:

Qualified — Rendered proper military courtesy to crew, passengers, and ground personnel. Polite and cheerful in dealing with all passengers.

Conditionally Qualified — Occasionally neglected to render proper courtesies.

Unqualified — Consistently lacking in military courtesy. Disagreeable or rude to officers, crew, passengers, or ground personnel.

8. Knowledge of first aid:

Qualified — Possessed an excellent knowledge of the fundamentals of first aid. Knew the location and use of all first aid equipment aboard.

Conditionally Qualified — Same as Qualified, but with minor discrepancies.

Unqualified — Little or no knowledge of the fundamentals of first aid. Did not know the location or use of the first aid equipment.

22.9 NATOPS EVALUATION QUESTION BANK

1. A "WARNING" is defined in NATOPS as:

- a. Any operating procedure, practice, or condition, etc., that may result in injury or death if not carefully observed or followed.
- b. An operating procedure, practice, or condition, etc., that may result in damage to equipment if not carefully observed or followed.

- c. An operating procedure, practice, or condition, etc., that is essential to emphasize.
- d. An operating procedure, practice, or condition, etc., that must be followed.
- 2. A "CAUTION" is defined in NATOPS as:
 - a. Any operating procedure, practice, or condition etc., that may result in injury or death if not carefully observed or followed.
 - b. An operating procedure, practice, or condition, etc., that may result in damage to equipment if not carefully observed or followed.
 - c. An operating procedure, practice, or condition, etc., that is essential to emphasize.
 - d. An operating procedure, practice, or condition, etc., that must be followed.
- 3. A "NOTE" is defined in NATOPS as:
 - a. Any operating procedure, practice, or condition, etc., that may result in injury or death if not carefully observed or followed.
 - b. An operating procedure, practice, or condition, etc., that may result in damage to equipment if not carefully observed or followed.
 - c. An operating procedure, practice, or condition, etc., that is essential to emphasize.
 - d. An operating procedure, practice, or condition, etc., that must be followed.

4.	Starter	use off.	is	time-limited	to	on,	off,	on,	off,	on,
5.	Propelle	er spe	eds	above		rpm indicate fail	ure of the prim	ary and overs	peed governor	s.

- a. 1,768.
- b. 1,700.
- c. 2,000.
- d. None of the above.
- 6. Total fuel capacity is _____ gallons; _____ gallons in each main fuel tank and _____ gallons in each auxiliary fuel tank.
 - a. 190; 79.5.
 - b. 269-5; 95; 39.75.
 - c. 539; 380; 159.
 - d. 390; 384; 190.
- 7. True or False: Under normal conditions the transfer of fuel from the auxiliary tank is automatic.
- 8. True or False: The stall warning system (horn) is accurate during icing conditions provided stall warning heat and wing deice are utilized properly.
- 9. True or False: The airstair door may be opened for ease in closing the cargo door.
- 10. The maximum operating cabin differential pressure is:
 - a. 4.6 psi.
 - b. 6.6 inches Hg.
 - c. 6.5 ± 0.1 psi.
 - d. 4.6 inches Hg.

- 11. Minimum N₁ on the right engine to operate the air-conditioner is:
 a. 0 percent. The air conditioner compressor is on the left engine.
 b. 62 percent.
 c. 70 percent.
 d. None of the above.
- 12. Compute how many minutes of oxygen are available under the following conditions:
 - a. O2 pressure 1,350 psig, IOAT 0 °C.
 - b. Crew Two (both using 100 percent).
 - c. Passengers Five.
 - d. Cabin Altitude 20,000 feet.
- 13. Mark all true statements regarding the passenger seats and headrests.
 - a. All seat backs must be upright and headrest properly positioned for all takeoffs and landings.
 - b. All seat backs must be upright, but only rear-facing seats must have their headrests properly positioned for all takeoffs and landings.
 - c. Only rear-facing seats must have their seat backs upright and headrests properly positioned for takeoffs and landings.
 - d. All forward-facing seats must have shoulder harness installed and in use for all takeoffs and landings.
- 14. V_{FE} for full down in the UC-12W is:
 - a. 144 KIAS.
 - b. 155 KIAS.
 - c. 158 KIAS.
 - d. 182 KIAS.
 - e. 200 KIAS.
- 15. V_{YSE} for the UC-12W is:
 - a. 86 KIAS.
 - b. 104 KIAS.
 - c. 135 KIAS.
 - d. 121 KIAS.
- 16. V_{MCA} for flaps approach is:
 - a. 86 KIAS.
 - b. 93 KIAS.
 - c. 99 KIAS.
 - d. 121 KIAS.
- 17. True or False: Takeoff is permitted with either fuel quantity gauge indicating in the yellow arc.
- 18. True or False: During engine start, a maximum ITT of 1,000 °C for 5 seconds is allowable.
- 19. During ground operations in low idle, the following engine operating limits must be observed:
 - a. ITT _____.

	b.	N ₁ rpm (min).
	c.	Oil pressure (min).
	d.	Oil temperature
20.	At	maximum cruise power, the following engine operating limits must be observed:
	a.	ITT/TGT
	b.	Torque (sec).
	c.	Propeller rpm
	d.	N_1 rpm
	e.	Oil pressure
	f.	Oil temperature
21.	Th	e following engine operating limits must be observed in maximum reverse:
	a.	ITT
	b.	Propeller rpm
	c.	Oil pressure
	d.	Oil temperature
22.	Th	e following transient limits on engine operation must be observed:
	a.	ITT for seconds.
	b.	Torque for seconds.
	c.	Propeller rpm for seconds.
	d.	N ₁ rpm
		Oil pressure
23.		e maximum zero fuel weight of the UC-12W is:
		12,500 pounds.
		10,400 pounds.
	c.	13,000 pounds.
	d.	Approximately 8,000 pounds (each aircraft is different depending on equipment installed).
		3,699 pounds (using JP-5).
24.	Ma	aximum gross weight for takeoff is:
	a.	13,590 pounds.
	b.	12,590 pounds.
	c.	13,500 pounds.
	d.	16,500 pounds.
		ne or False: The V_{MO} is 259 KIAS for the UC-12W between sea level and 24,000' MSL.
26.	In	the C-12W, the maximum speeds for landing gear retraction and extension are:
	a.	155 KIAS; 200 KIAS.
	b.	164 KIAS; 182 KIAS.

	c.	182 KIAS for both.
	d.	163 KIAS; 181 KIAS.
27.	For	the UC-12W, V _{SSE} is:
	a.	86 KIAS.
	b.	91 KIAS.
	c.	104 KIAS.
	d.	135 KIAS.
28.	If a	cold oil check indicates more than 3 quarts low, you should:
	a.	Start the engine and run it until oil temperature is a minimum of 30 $^{\circ}$ C, then shut down and recheck the oil level.
	b.	Motor the engine for 15 to 20 seconds, then recheck the oil level.
	c.	Add enough oil to bring the level back to between zero and 1 quart low.
	d.	Call maintenance.
29.	Bet	fore fuel is introduced during a ground start, N ₁ must rise at or above:
	a.	16 percent.
	b.	12 percent.
	c.	10 percent.
	d.	None of the above.
30.	Tru	e or False: When using a GPU for start, it is recommended to start the left engine first.
31.		to ITT rise is observed within seconds after moving the condition lever to LOW IDLE, you build
	a.	10; discontinue the start by moving the condition lever to FUEL CUTOFF and turning starter OFF.
	b.	10; discontinue the start by moving the condition lever to FUEL CUTOFF, moving the starter switch to STARTER ONLY for 15 to 40 seconds, then to OFF.
	c.	20; discontinue the start by moving the condition lever to FUEL CUTOFF and turning starter OFF.
	d.	20; discontinue the start by moving the condition lever to FUEL CUTOFF, moving the start switch to STARTER ONLY for 15 to 40 seconds, then to OFF.
32.	Eng	gine clearing procedures call for the starter (only) to be selected for:
	a.	15 to 20 seconds.
	b.	15 to 40 seconds.
	c.	Maximum of 30 seconds.
	d.	Maximum of 40 seconds.
33.	Un	der normal conditions, it is recommended that taxi speed be controlled with the use of:
	a.	Brakes.
	b.	Beta range.
		Aerodynamic braking.
	c.	Actodynamic oraxing.

34.	Du	ring the overspeed governor check in the Engine Runup Checklist, the propeller rpm should stabilize at:				
	a.	2,080 (±40 rpm).				
	b.	1,600 to 1,640 rpm.				
	c.	1,500 to 1,610 rpm.				
	d.	None of the above.				
35.	Au	toignition should be armed and dearmed				
	a.	During icing flights and at night above 14,000 feet; at all other times.				
	b.	Before takeoff; after landing.				
	c.	After engine start; before engine shutdown.				
	d.	A and B above.				
36.	Th	e propeller controls should be set to high rpm during a reverse thrust landing in order to:				
	a.	Make sure constant reversing characteristics.				
	b.	Prevent the primary governor from influencing propeller reversal.				
	c.	Shorten the landing distance.				
	d.	A and C.				
	e.	All of the above.				
37.	During a reverse thrust landing, the propellers should be moved out of the reverse range above knots, if possible, to minimize propeller blade erosion.					
	a.	40.				
	b.	50.				
	c.	60.				
	d.	Prior to coming to a complete stop.				
38.	Tru	ne or False: Approach flaps are normally selected during a waveoff.				
39.	Th	e procedures for a two-engine waveoff (in order) are:				
	a.	·				
	b.	<u>.</u>				
	c.	.				
	d.	•				
	e.	•				
40.	То	account for power setting accuracy, and steady state fluctuations, inadvertent torque excursions up to are time limited to minutes.				
41.	To	simulate zero thrust:				
	a.	Set power lever to IDLE, propeller lever to FEATHER.				
	b.	Zero thrust should not be set below 4,000 feet AGL.				
	c.	Set 120 foot-pounds of thrust, 1,100 rpm.				
	d.	Set 5% torque, 1,700 rpm.				

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42. List in order the procedures for engine fire on the deck:

	a.		
	b.		
	c.		
	d.		
43.	At rer		left engine chip detect light. With 6,000 feet of runway
	a.	<u> </u>	
	b.	<u> </u>	
44.		nmediately after liftoff at 105 KIAS, you experienway remain. List, in order, the steps to be take	nce a complete failure of the left engine; only 500 feet of en immediately.
	a.	•	
	b.	<u> </u>	
	c.		
	d.	·	
45.	Wl	Then flying in cruise flight, the left chip detect light	ght illuminates. What should you do?
	a.	Check for secondary indications; if normal, foot-pounds or less of torque).	continue operation at a reduced power setting (1,100
	b.	Check for secondary indications. If abnormal using the Engine Fire or Failure In-Flight Che	or fluctuation indications are found, secure the engine ecklist.
	c.	Secure the engine using Emergency Shutdown	n Checklist.
	d.	A and B only.	
46.	Lis	ist the steps in the Engine Fire or Failure In-Flig	ht Checklist in order:
	a.	<u> </u>	
	b.	<u> </u>	
	c.	<u> </u>	
	d.	<u> </u>	
47.		rue or False: The propeller on the dead engine sl rstart.	nould not be feathered prior to conducting a windmilling
48.	Wl	hat are the limits on windmilling airstarts?	
	a.	Airspeed above 140 KIAS, altitude below 20,	000 feet.
	b.	Airspeed above 140 KIAS, altitude below 21,	000 feet.
	c.	Airspeed above 130 KIAS, altitude below 20,	000 feet.

49. True or False: Before the cabin fire extinguisher is operated, the cabin should be depressurized and the pilot and copilot storm windows opened.

50. True or False: Failure of the primary (engine-driven) fuel pump will result in engine flameout.

d. None of the above.

51. True or False: Crossfeed may be used in normal operation to correct fuel imbalances of greater than 500 pounds.

52.	Lis	st the steps in order for an emergency descent:
	a.	·
	b.	·
	c.	<u> </u>
	d.	.
	e.	.
53.		st six ways the autopilot may be intentionally disengaged:
	a.	.
	b.	.
	c.	·
		·
	e.	<u> </u>
	f.	.
54.		ue or False: With the DOOR UNLOCK annunciator illuminated, the cabin door should be visually ecked for security prior to landing.
55.	Wi	ith cracked outer windshield panel, what action should be taken?
	a.	No immediate action required.
	b.	Depressurized to a maximum of 4.0 psig within 10 minutes.
	c.	Descent below 25,000 feet and depressurized to 4.6 psig or less.
	d.	Dump pressurization, land as soon as possible.
56.		st the procedures to follow prior to manually extending the gear if one or more of the landing gear fails extend or to indicate safe:
	a.	·
	b.	·
	c.	·
	d.	·
	e.	·
	f.	·
	g.	·
	h.	·
57.		ue or False: Before executing an intentional wheels-up landing, all field arresting cables should be moved.
58.	Du on	uring sustained icing conditions, a minimum of should be maintained to prevent ice accumulation unprotected surfaces of the wing.
	a.	170 KIAS.
	b.	140 KIAS.
	c.	170 KIAS.

	d.	155 KIAS.
59.	Su	rface deicers should be actuated only afterof ice have accumulated on wing surfaces.
		1/2 to 1 inch.
	b.	1 to 2 inches.
	c.	1 to 1 1/2 inches
	d.	Over 2 inches.
60.		e UC-12W is approved for flight into known icing conditions provided the following equipment is erable:
	a.	·
	b.	·
	c.	·
	d.	.
	e.	.
		.
	g.	.
		.
	i.	·
	j.	·
61.	Tu	rbulent air penetration speed for the UC-12W is:
	a.	115 KIAS.
	b.	121 KIAS.
	c.	170 KIAS.
	d.	245 KIAS.
62.	Wł	nat is the minimum acceptable takeoff power under the following conditions?
	a.	6,000 feet pressure altitude
	b.	+30 °C OAT
	c.	65 KIAS
	d.	Ice vanes retracted
63.		nat is the accelerate-go distance and accelerate-stop distance for flaps 0 percent and 40 percent under the lowing conditions?
	a.	12,000-pound gross weight
	b.	10-knot headwind component
	c.	2,000-foot pressure altitude
	d.	+30 °C OAT
64.		nat is the V_R , V_X , takeoff ground roll distance, and distance to clear a 50-foot obstacle under the following aditions?
	a.	+30 °C OAT .

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	b.	Flaps 0 percent
	c.	2,000-foot pressure altitude
	d.	13,400-pound gross weight
	e.	5-knot headwind component
65.		nat is the two-engine rate of climb and target speed with flaps at 0 percent and at 40 percent under the lowing conditions?
	a.	2,000-foot pressure altitude
	b.	+30 °C OAT
	c.	12,000-pound gross weight
66.	Wł	nat is the single-engine rate of climb and target speed under the following conditions?
	a.	Flaps 0 percent
	b.	2,000-foot pressure altitude
	c.	0 °C OAT, ice vanes extended
	d.	12,000-pound gross weight
67.	Wł	nat is the performance cruise power torque, total fuel flow, and TAS under the following conditions?
	a.	26,000-foot pressure altitude
	b.	-24 °C OAT
	c.	12,000-pound gross weight
68.		nat is the approach speed, landing ground roll, and distance to clear a 50-foot obstacle under the following additions?
	a.	Flaps 0 percent
	b.	Propeller reversing used
	c.	Wet runway
	d.	2,000-foot pressure altitude
	e.	10 °C OAT, 10-knot headwind component
	f.	11,500-pound gross weight
69.	Th	e cabin AIRSTAIR DOOR is secured for by the following devices?
	a.	4 micro-switches and 4 bayonet pin latching bolts.
	b.	4 micro-switches and 2 upper door latching hooks.
	c.	4 bayonet pin latching bolts and 2 upper door latching hooks.
	d.	6 rotating hollow crescent latches.
	Co	mpliance with which graph shows the aircraft can accelerate to V_1 , lose an engine, and climb as certified?
70.	a.	Accelerate-Go.
70.		
70.	b.	Take-off Field Length.
70.	b. c.	Take-off Field Length. Close-in Take-off Flight Plan.

71. Testing the FIRE DETECTION system checks which of the following components?

- a. The physical integrity of the sensing tubes.
- b. The operational status of the responder unit
- c. Electrical continuity in the sensor system.
- d. All of the above.
- 72. The fire detection system is designed to give a warning for which of the following condition?
 - a. A nacelle fuel tank fire.
 - b. An engine compartment over temp.
 - c. An ITT exceeding 1,100 °C.
 - d. An nacelle temperature above 300 °C.
- 73. Before you can discharge the FIRE EXTINGUISHER, which condition must first be met?
 - a. Firewall Fuel Valve button pushed.
 - b. Firewall Fuel Valve Closed.
 - c. [FIRE WARNING] annunciator illuminated.
 - d. All of the above.
- 74. The engine accessory section is driven by which of the following?
 - a. The N_1 shaft.
 - b. The N₂ shaft
 - c. The starter shaft.
 - d. The power turbine shaft.
- 75. The ESIS system altitude display is generated from the?
 - a. # 2 static system.
 - b. # 1 static system.
 - c. Static system contained within the ESIS ADC.
 - d. Pilot's side PFD.
- 76. Which engine gauges will continue to indicate with a total electrical failure?
 - a. ITT, Fuel Flow, Prop RPM.
 - b. ITT, N₁ RPM, Prop RPM.
 - c. Torque, Fuel Flow, Oil Pressure/Temperature.
 - d. None of the gauges.
- 77. Oil in the PT6A-60A engine performs the following functions?
 - a. Engine lubrication, feather the prop, heats the fuel.
 - b. Feather the prop, heats the fuel, provide torque indication.
 - c. Engine lubrication, Feather the prop, provide torque indication.
 - d. Engine lubrication, heats the fuel, provide torque indication.
- 78. What is the purpose of having a Flight Low Pitch Stop setting?
 - a. To prevent excessive propeller RPM.

- b. To prevent excessive propeller drag in flight.
- c. To keep the propeller above 1050 RPM.
- d. To prevent the propeller from feathering when power levers are retarded.
- 79. An illuminated [PROP PITCH] annunciator indicates which of the following conditions?
 - a. The REVERSE power range is ready for use.
 - b. The pilot has selected the GROUND LOW PITCH setting.
 - c. The aircraft weight is felt on the right main gear safety switch.
 - d. The propeller blade has decreased below the Flight Low Pitch Stop.
- 80. The purpose of the Ground Low Pitch Stop is best described in which of the following statements?
 - a. Prevents excessive thrust in flight and allows the prop to feather after engine shutdown.
 - b. Prevents excessive thrust on the ground and keeps prop RPM above resonance range.
 - c. Keeps prop RPM above 1,050 RPM and prevents excessive thrust on the ground.
 - d. Keeps prop RPM above the resonance range and prop feathering after engine shutdown.
- 81. What action is initiated by the Fuel Topping Governor to limit prop RPM?
 - a. P₃ air pressure is reduced to the fuel control.
 - b. Fuel pressure is used to reduce propeller blade angle.
 - c. The pilot valve is open to reduce oil pressure in the propeller dome.
 - d. The beta valve is open to increase oil pressure in the propeller dome.
- 82. Which quantity is indicated when the FUEL QUANTITY switch is in the center position?
 - a. Fuel quantity in the wings.
 - b. Fuel quantity in the aircraft.
 - c. Fuel quantity in the AUX TANKS.
 - d. Fuel quantity in the MAIN TANKS.
- 83. Illumination of the [FUEL QUANTITY] annunciator indicates which of the following conditions?
 - a. There is less than 265 lbs of fuel remaining.
 - b. The main fuel tank indicators have reached the yellow arc on the gauge.
 - c. There is less than 30 minutes fuel remaining at cruise power setting.
 - d. There is less than 30 minutes fuel remaining at maximum continuous power setting.
- 84. With fuel in the auxiliary fuel tank, which of the following options is assured when the [NO TRANSFER] annunciator extinguishes after engine start?
 - a. Fuel is being drawn from the wing tanks.
 - b. Nothing until the standby boost pump is turned on.
 - c. Fuel is being transferred from the nacelle tank to the auxiliary tank.
 - d. The motive flow valve has opened and there is fuel pressure in the motive flow fuel lines.
- 85. What are the functions of the STANDBY BOOST PUMP?
 - a. Provides motive flow pressure in the event of an engine driven boost pump failure.

- b. Provides fuel to the FCU in the event of a high pressure fuel pump failure.
- c. Crossfeeds fuel from side of the aircraft to the opposite engine.
- d. a. and c.
- 86. Illumination of the green [CROSSFEED] annunciator indicates which of the following?
 - a. The crossfeed valve is open.
 - b. The crossfeed system has been selected.
 - c. Fuel is being pumped to the opposite engine.
 - d. Fuel is being transferred from the auxiliary tank to the nacelle tank.
- 87. If the generator bus ties were manually closed before engine start, which of the following actions would extinguish the [MAN TIES CLOSED] annunciator after start?
 - a. Placing a generator on line.
 - b. Applying external power to the aircraft.
 - c. Placing the GEN TIES SWITCH in the OFF position.
 - d. Selecting the BUS SENSE SWITCH to RESET momentarily.
- 88. Which statement is true if the starter switch was left on a few minutes after engine start?
 - a. The starter must be replaced within 10 hours.
 - b. The starter limitations have all been exceeded.
 - c. The starter should be inspected as soon as possible.
 - d. The starter switch should be moved to OFF position and the governor placed on line.
- 89. Which statement is true concerning a dual generator load shed situation?
 - a. Items with a white circle around their switch are inoperable.
 - b. Items with a white circle around their switch are operable.
 - c. Co-pilot panel circuit breakers located along a white line are operable.
 - d. Co-pilot panel circuit breakers located along a white line are inoperable.
- 90. With OAT greater than 10 °C which of the following switch positions are required?
 - a. ENVIR BLEED AIR-LOW or AUTO.
 - b. ENVIR BLEED AIR-NORM.
 - c. BLEED AIR VALVES-OPEN.
 - d. BLEED AIR VALVES-ENVIRO OFF.
- 91. Selecting DUMP with the CABIN PRESS switch at FL 200 will cause which of the following to occur?
 - a. Cabin pressure climbs rapidly to 20,000 feet.
 - b. The ram air door opens to dump cabin pressure.
 - c. Cabin altitude climbs to approximately 13,500 feet.
 - d. The pressurization flow pack environmental valve closes.
- 92. Which of the following actions will occur if the CABIN PRESS switch is inadvertently moved from PRESS position to TEST position?
 - a. Nothing.

- b. The cabin altitude will climb at a rate equal to 6.6 PSID.
- c. The airstair door will inflate and CABIN PRESET SOLENOID will open.
- d. The cabin will be driven into a descent to test pressurization.
- 93. At which of the following altitudes will the red warning annunciator illuminate to show rising cabin altitude?
 - a. 10,000 ft.
 - b. 12,000 ft.
 - c. 12,500 ft.
 - d. 13,500 ft.
- 94. When is take-off permitted with a single ADC?
 - a. Only if the flight director is not used.
 - b. Only if the autopilot is not used.
 - c. Take-off is not permitted with an ADC inoperative.
 - d. Only if the reversionary ADC switch is selected to the operative ADC.
- 95. If the co-pilot's static ports become completely blocked at rotation speed, what would be true during the climb?
 - a. All indicated airspeeds would increase.
 - b. The co-pilot and ESIS indicated airspeeds would decrease.
 - c. The pilot's indicated airspeed would increase.
 - d. The # 2 air data computer would compensate for changes in airspeed indication.
- 96. The environmental flow control packs provide air to the cabin for what purpose?
 - a. Side window defogging.
 - b. Pressurization.
 - c. Environmental temperature control.
 - d. b. and c.
- 97. Which of following situations will deploy the First Aid oxygen masks?
 - a. When the cabin altitude exceeds 12,000 ft.
 - b. When the cabin altitude exceeds 12,500 ft.
 - c. When the overhead access door is manually pulled open.
 - d. When the Passenger Dropout Handle is pulled.
- 98. What is the approximate usable O₂ duration in cruise at FL 230, ISA + 31 °C, with 8 passengers, 2 pilots, and a 77 ft³ O₂ bottle reading 1,300 psi?
 - a. 22 minutes.
 - b. 28 minutes.
 - c. 32 minutes.
 - d. 36 minutes.
- 99. Regulated pneumatic air supplies pressure to accomplish which of the following tasks?
 - a. Inflate the Surface De-Ice boots.

- b. Operate the Brake De-ice system.
- c. Determine when the rudder boost should activate.
- d. Illuminate the [BLEED AIR] warning lights.
- 100. What will happen if the 18 psi regulator in the Pneumatic and Vacuum System fails in the relief mode?
 - a. The pneumatic pressure will be approximately 21 psi.
 - b. The cabin altitude will climb approximately 1,800 to 2,500 feet per minute.
 - c. The Schrader Valves in the Outflow and Safety Valves will prevent excessive pressurization.
 - d. The airstair door seal will deflate and pressurization control will fail.
- 101. Which of the following causes the RUDDER BOOST test?
 - a. Difference between left and right engine unregulated pneumatic air.
 - b. Difference between left and right engine environmental pneumatic air.
 - c. Difference between left and right engine torque.
 - d. Difference between left and right engine 18 psi regulated pneumatic air.
- 102. Which of the following indicates a successful RUDDER BOOST test?
 - a. Left Power Lever forward, Right Rudder Pedal forward.
 - b. Right Power Lever forward, Left Rudder Pedal forward.
 - c. Right Power Lever forward, Right Rudder Pedal forward.
 - d. Left Power Lever forward, [RUDDER BOOST] annunciator illuminated.
- 103. Which of the following systems are required to be activated during flight in icing conditions?
 - a. Auto-Ignition and Windshield Heat.
 - b. Auto-Ignition, Prop De-Ice, and Windshield Heat.
 - c. Auto-Ignition, Engine Anti-Ice Vanes.
 - d. Prop De-Ice, Engine Anti-Ice Vanes.
- 104. Which of the following systems are required to be activated during flight in icing conditions?
 - a. Auto-Ignition and Windshield Heat.
 - b. Auto-Ignition, Prop De-Ice, and Windshield Heat.
 - c. Auto-Ignition, Engine Anti-Ice Vanes.
 - d. Prop De-Ice, Engine Anti-Ice Vanes.
- 105. Under what conditions should the Engine Anti-Ice Vanes be extended?
 - a. All grounded operations.
 - b. +5 °C ambient temperature in visible moisture.
 - c. +5 °C IOAT in visible moisture.
 - d. a. and b.
- 106. What is the maximum flaps extension speed?
 - a. 166 KIAS.
 - b. 181 KIAS.

- c. 158 KIAS.
- d. 202 KIAS.
- 107. After a full flap landing, the Flap Handle is raised to the APPROACH position. What will the flaps do?
 - a. The flaps will not move.
 - b. The flaps will retract and stop at the APPROACH position.
 - c. The flaps will fully retract and then extend to the APPROACH position.
 - d. The flaps will move as selected unless the Flap Position Transducer is inoperative.
- 108. Which of the listed power sources are required to operate the landing gear system?
 - a. Left generator and triple fed bus.
 - b. Right generator and triple fed bus.
 - c. Center and triple fed bus.
 - d. Center fed bus only.
- 109. After the Landing Gear Handle is moved UP, what must also happen to begin the retraction sequence?
 - a. [HYD FLUID LOW] annunciator extinguished and weight off the Left Landing Gear Safety Switch.
 - b. [HYD FLUID LOW] annunciator extinguished and weight off the Right Landing Safety Switch.
 - c. Weight must be off the Left and Right Landing Gear Safety Switch.
 - d. Weight must be off all three landing gear.
- 110. If normal landing gear extension is attempted with a [HYD FLUID LOW] annunciator illuminated, which of the following scenarios will most likely occur?
 - a. The landing gear motor will not operate.
 - b. Use of the standby (manual) reservoir may render the brakes inoperative.
 - c. The landing gear may not fully extend without the use of the Manual Hand Pump.
 - d. The landing gear will extend normally but the manual extension system will not work.
- 111. With only green landing gear indicators illuminated, which indications reinforce the probability that all landing gear are down and locked?
 - a. [HYD FLUID LOW] and [RSV NOT READY] annunciators extinguished.
 - b. [HYD FLUID LOW] annunciator is extinguished and the Landing Gear Horn does not sound with flaps at FULL.
 - c. [RSV NOT READY] annunciators is extinguished and the landing gear handle red light remains extinguished with power levers below $86\% N_1$.
 - d. The Landing Gear Horn does not sound with flaps fully extended and the Gear Handle Light remains extinguished with power levers below $86\%~N_1$.
- 112. Which statement is true regarding the two exit lights mounted in the cabin headliner?
 - a. The lights are activated by the instrument Emergency Light Switch.
 - b. Each light is powered only by a set of internal, flashlight batteries.
 - c. The lights are activated by the Cabin Entry/threshold Lights Switch.
 - d. Each light has two light sources and can be activated by rapid deceleration.
- 113. What is the reason for not holding steady pressure on the inboard brake pedal while turning?

- a. It may cause excessive rudder deflection.
- b. It may roll the outboard tires off the rims.
- c. It may induce a twisting action on the strut, inflicting serious damage.
- d. It may distort the soft metal block on the rear of the nosewheel strut.
- 114. If the pilot's pitot tube becomes completely blocked at rotation, what would be true during the climb?
 - a. The indicated airspeed will increase.
 - b. The indicated airspeed will decrease.
 - c. The indicated airspeed will continuously read the speed of rotation.
 - d. The Air Data Computer will compensate for changes in the airspeed indication.
- 115. Which of the following statements is true when selecting Alternate Static Air Source?
 - a. The aircraft is approximately 7 knots faster and 70 feet lower than indicated.
 - b. The aircraft is approximately 7 knots faster and 70 feet higher than indicated.
 - c. The aircraft is approximately 7 knots slower and 70 feet lower than indicated.
 - d. The aircraft is approximately 7 knots slower and 70 feet higher than indicated.
- 116. Which statement best describes the avionics system response to a loss of the triple fed bus power?
 - a. Comm 1 and Comm 2 will be inoperative.
 - b. Pulling the avionics circuit breaker will restore operation of all radios.
 - c. Selecting AUDIO EMER will restore operation of all radios.
 - d. All radios will be inoperative except GROUND COMM backup function.
- 117. Which statement is true regarding the multi-function display?
 - a. The multi-function display is powered when a generator comes on line.
 - b. The multi-function display must be operational before engine start.
 - c. Engine start can be accomplished with the multi-function display in reversionary mode.
 - d. The generator ties must be closed to power the multi-function display prior to engine start.
- 118. If the AVIONICS MASTER POWER switch should fail in the OFF position which of the following procedures would be followed to apply power to the aircraft avionics system?
 - a. Pull the AVIONICS MASTER POWER circuit breaker.
 - b. Pull the pilots and copilots AUDIO circuit breaker.
 - c. Depress the GROUND COMM switch to restore power.
 - d. Select AUDIO EMER on the Avionics Control Panel.

PART XI

Weight and Balance

Chapter 23 — Weight and Balance

CHAPTER 23

Weight and Balance

Note

Each airplane is delivered with sample loading, empty weight and center of gravity, and equipment list, all pertinent to that specific airplane. It is the owner's responsibility to ensure that changes in equipment are reflected in a new weight and balance and in an addendum to the equipment list. Refer to the Basic Empty Weight Record.

23.1 CONVERSION FACTORS

Secondary metric units, except inches, have been added to this section by using the following conversion factors:

- 1. WEIGHT: 1 Kilogram = 2.2046 Pounds.
- 2. LIQUID VOLUME: 1 Liter = 0.2642 Gallon.
- 3. WEIGHT/LIQUID VOLUME: 1 Kilogram/Liter = 8.3444 Pounds/Gallon.
- 4. MOMENT: 1 Kilogram-Inch = 2.2046 Pound-Inches.

23.2 WEIGHING INSTRUCTIONS

Periodic weighing of the airplane may be required to keep the Basic Empty Weight current. Frequency of weighing is to be determined by the operator. All changes to the airplane affecting weight and/or balance are the responsibility of the airplane operator.

- 1. Airplane may be weighed on wheels or jacks points. Three jack points are provided: one on the nose section of the fuselage at station 83.5, and one on each wing center section rear spar at station 239.9. Wheel reaction locations should be measured as described in step 6. below.
- 2. Fuel should be drained preparatory to weighing. Tanks are drained from the regular drain ports with the airplane in static ground attitude. Add the Total Drainable Unusable Fuel weight of 48.0 lb (22 kg) and moment of 9,141 lb-in (4,125 kg-in) to the "Total (As Weighed)" weight and moment, to derive the Basic Empty Weight.
- 3. Engine oil must be at the full level in each tank.
- 4. To determine the airplane configuration at the time of weighing, installed equipment is checked against the current airplane equipment list. All equipment must be in its proper place during weighing. Remove all loose equipment and items that are not a part of the Basic Empty Weight.
- 5. The airplane is placed on the scales in a level attitude. Leveling screws are located on the cargo door aft frame. Leveling is accomplished with a plumb bob. Jack pad leveling may require the nose gear strut to be secured in the static position to prevent its extension. Wheel weighings can be leveled by varying the amount of air in the struts and tires.
- 6. Measurement of the reaction arms for a wheel weighing is made using the nose jacking point for a reference. Measurements are taken with the airplane level on the scales from a reference (a plumb bob hung from the center of the main jacking point) to the axle center line of the main gear and then from the main gear axle center line to the nose wheel axle center line. The main wheel axle center line is best located by stretching a string across from one main wheel to the other. All measurements are to be taken with the tape level with the hangar floor and parallel to the fuselage center line. The locations of the wheel reactions will be approximately at an arm of 223 inches for main wheels and 30 inches for the nose wheel.
- 7. Weighing should always be made in a enclosed area which is free from air currents. The scales used should be calibrated and certified in accordance with the basic tolerance values of National Bureau of Standards Handbook 44.

Figure 23-1. Basic Empty Weight and Balance

BASIC EMPTY WEIGHT AND BALANCE

acility: Serial No.:										
REFEREN	ICE DIME	ENSIC	ONS IN	FUSELA	GE STA	TIONS (IN	CHES	AFT OF D	ATUM)	
Wheel Axle Centerline	e :		Nose		Main			Jack	Point Lo	cations:
Extended Strut			29.4		222.9			Forwa	ard	83.5
Compressed Strut			30.8		225.4	(Aft		239.5
REACTION Wheel or Jack Point	SCAI READ		Т	ARE	NET	WEIGHT		ARM	M	OMENT
	*()	*()	*()	*()	*()
Left Main										
Right Main										
Sub Totals — Main										
Nose										
Total — As Weight										
	Add	itions	and Su	btraction	s to as W	eighed Co	onditio	ns:		
Add: Drainable Unusab	le Fuel				4	8 (22)			914	11 (4125)
										= =
BASIC EMPTY WEIGH	IT (BEW)									
* Enter Units Used: lb &	lb-in or l	kg & k	g-in							
Note: The Basic Empty	Weight in	nclude	es full e	ngine oil	and unus	sable fuel.				
	_									
	F									
		Title	:							

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Figure 23-2. Basic Empty Weight (BEW) Record

	BASIC EMPTY WEIGHT (BEW) RECORD									
erial Num	iber:						Page N			
Date	Item In Out	Description of Item or Modification	We Added (eight Cha (+) or Rer	nge noved (-)	Running	Basic Em	oty Weight		
			Weight Arm Mom		Mom/100 *()	Weight *()	Arm (in.)	Mom/100 *()		
						` '				
	++									
	++									
	++									
	++									

^{*} Enter units used: Ib and Ib-in. or kg and kg-in.

Figure 23-3. Dimensional And Loading Data

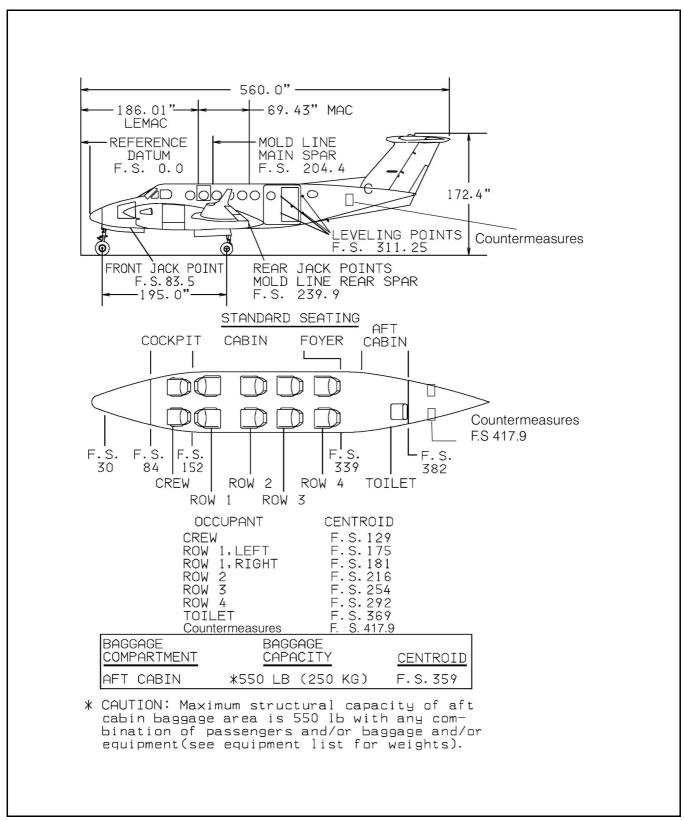
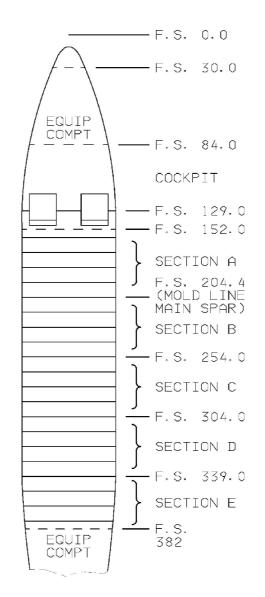


Figure 23-4. Loading Data (Cargo Configuration)

NOTES:

- 1. ALL CARGO IN SECTIONS A, B, C & D MUST BE SUPPORTED ON AND SECURED TO THE SEAT TRACKS BY AN FAA APPROVED SYSTEM.
- 2. CONCENTRATED CARGO LOADS IN SECTIONS A,B,C, & D MUST NOT EXCEED 200 LB (91 KG) PER SQUARE FOOT & MUST BE SUPPORTED ON THE SEAT RAILS.
- 3. CARGO IN SECTION E IS TO BE SECURED BY BEECH FURNISHED BAGGAGE NET, WEBBING, OR STRAPS.
- 4. FOOTMAN LOOPS IN SECTION E ARE TO BE USED TO SECURE CARGO/BAGGAGE IN THAT AREA ONLY.
- 5. CONCENTRATED FLOOR LOAD-INGS OF CARGO OR BAGGAGE IN SECTION E MUST NOT EXCEED 100 LB (45 KG) PER SQUARE FOOT.
- 6. ANY EXCEPTIONS TO THE ABOVE PROCEDURES WILL REQUIRE APPROVAL BY A LOCAL FAA OFFICE.



SECTION	MAXIMUM	CENTROID ARM
ABCDI	1200 LB (544 KG) 860 LB (390 KG) 890 LB (404 KG) 490 LB (222 KG)	F.S. 178.0 F.S. 229.0 F.S. 279.0 F.S. 321.0
E	550 LB (250 KG)	. F.S. 359.0

CARGO TIEDOWN PROVISIONS ARE NOT PROVIDED

Figure 23-5. Passenger Seating Configurations Payload Locations

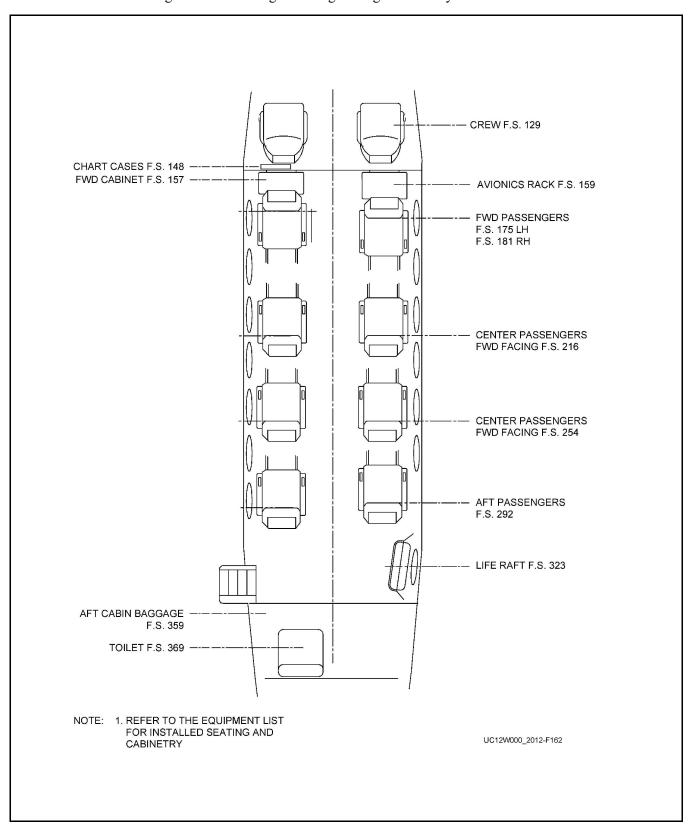


Figure 23-6. Change From Passenger to Cargo Configuration

CHANGE FROM PASSENGER TO CARGO CONFIGURATION

Date	Ser. No				
ITEM	Weight	Arm	Moment		
	*()	(in.)	*()		
Basic Empty Weight - Passenger Configuration					
Space Below Provided For Additions and Subtract	ions to Passenger	· Configuration	١.		
Basic Empty Weight - Cargo Configuration					
* Enter Units Used: lb & lb-in or kg & kg-in			UC12W000 2012-F163		

Figure 23-7. Useful Load Weights And Moments Occupants (Pounds)

WEIGHT	CREW		C	ABIN CHAIR	s		TOILET SEAT
(LB)	F.S. 129	F.S. 175	F.S. 181	F.S. 216	F.S. 254	F.S. 292	F.S. 369
			MON	IENTS/100 (L	B-IN)		
80	103	140	145	173	203	234	295
90	116	158	163	194	229	263	332
100	129	175	181	216	254	292	369
110	142	193	199	238	279	321	406
120	155	210	217	259	305	350	443
130	168	228	235	281	330	380	480
140	181	245	253	302	356	409	517
150	194	263	272	324	381	438	554
160	206	280	290	346	406	437	590
170	219	298	308	367	432	496	627
180	232	315	326	389	457	526	664
190	245	333	344	410	483	555	701
200	258	350	362	432	508	584	738
210	271	368	380	454	533	613	775
220	284	385	398	475	559	642	812
230	297	403	416	497	584	672	849
240	310	420	434	518	610	701	886
250	323	438	453	540	635	730	923

Figure 23-8. Useful Load Weights And Moments Occupants (Kilograms)

WEIGHT	CREW		C	ABIN CHAIR	s		TOILET SEAT				
(KG)	F.S. 129	F.S. 175	F.S. 181	F.S. 216	F.S. 254	F.S. 292	F.S. 369				
		MOMENTS/100 (KG-IN)									
35	45	61	63	76	89	102	129				
40	52	70	72	86	102	117	148				
45	58	79	81	97	114	131	166				
50	65	88	91	108	127	146	185				
55	71	96	100	119	140	161	203				
60	77	105	109	130	152	175	221				
65	84	114	118	140	165	190	240				
70	90	123	127	151	178	204	258				
75	97	131	136	162	191	219	277				
80	103	140	145	173	203	234	295				
85	110	149	154	184	216	248	314				
90	116	158	163	194	229	263	332				
95	123	166	172	205	241	277	351				
100	129	175	181	216	254	292	369				
105	135	184	190	227	267	307	387				

Figure 23-8. Useful Load Weights And Moments Occupants (Kilograms) (cont.)

WEIGHT	CREW		CABIN CHAIRS							
(KG)	F.S. 129	F.S. 175	F.S. 181	F.S. 216	F.S. 254	F.S. 292	F.S. 369			
		MOMENTS/100 (KG-IN)								
110	142	193	199	238	279	321	406			
115	148	201	208	248	292	336	424			

Figure 23-9. Useful Load Weights And Moments Cabinet Contents And Baggage (Pounds)

	CABINET	CONTENTS	BAGGAGE				
MEIGHT (LD)	CHART CASES	FORWARD CABINET	AFT CABIN				
WEIGHT (LB)	F.S. 148	F.S. 157	F.S. 359				
	MOMENTS/100 (LB-IN)						
10	15	16	36				
20	30	31	72				
30	44	47	108				
40	59	63	144				
50	74	79	180				
60		94	215				
70		110	251				
80		126	287				
90		141	323				
100		157	359				
200			718				
300			1,077				
400			1,436				
500			1,795				
510			1,831				
550			1,975				

NOTES:

Each cabinet has the drawers and compartments individually placarded for maximum weight capacity. Liquid dispensers are not placarded and the contents are in addition to the cabinet maximum weights.

Figure 23-10. Useful Load Weights And Moments Cabinet Contents And Baggage (Kilograms)

	CABINET	CONTENTS	BAGGAGE				
MEIGHT (KO)	CHART CASES	FORWARD CABINET	AFT CABIN				
WEIGHT (KG)	F.S. 148	F.S. 157	F.S. 359				
	MOMENTS/100 (KG-IN)						
5	7	8	18				
10	15	16	36				
15	22	24	54				
18	27	28	65				
23	34	36	83				

Figure 23-10. Useful Load Weights And Moments Cabinet Contents And Baggage (Kilograms) (cont.)

	CABINET	CONTENTS	BAGGAGE
WEIGHT (KO)	CHART CASES	FORWARD CABINET	AFT CABIN
WEIGHT (KG)	F.S. 148	F.S. 157	F.S. 359
30		47	108
35		55	126
40		63	144
45		71	162
50			180
100			359
150			539
200			718
231			829
249			894

NOTES:

Each cabinet has the drawers and compartments individually placarded for maximum weight capacity. Liquid dispensers are not placarded and the contents are in addition to the cabinet maximum weights.

Figure 23-11. Useful Load Weights And Moments Cargo (Pounds)

	COMPART	MENT — REFER T	O LOADING DATA	A (CARGO CONFIC	GURATION)					
WEIGHT (LB)	A F.S. 152 - 204	A B C F.S. 152 - 204 F.S. 204 - 254 F.S. 254 - 304		D F.S. 304 - 339	E F.S. 339 - 382					
(22)	CENTROID									
		MC	OMENTS/100 (LB-	IN)						
	F.S. 178	F.S. 229	F.S. 279	F.S. 321	F.S. 359					
100	178	229	279	321	359					
200	356	458	558	642	718					
300	534	687	837	963	1,077					
400	712	916	1,116	1,284	1,436					
490	872	1,122	1,367	1,573	1,759					
500	890	1,146	1,395		1,795					
550	979	1,260	1,535		1,975					
600	1,068	1,374	1,674							
700	1,246	1,603	1,953							
800	1,424	1,832	2,232							
860	1,531	1,969	2,399							
890	1,584		2,483							
900	1,602									
1,000	1,780									
1,100	1,958									
1,200	2,136									

NOTES:

All cargo must be supported by the seat tracks and tied down to the tracks by an FAA-approved method.

Figure 23-12. Useful Load Weights And Moments Cargo (Kilograms)

	COMPARTMENT — REFER TO LOADING DATA (CARGO CONFIGURATION)									
WEIGHT (KG)	A F.S. 152 - 204	B F.S. 204 - 254	C F.S. 254 - 304	D F.S. 304 - 339	E F.S. 339 - 382					
- (-,	CENTROID									
	MOMENTS/100 (KG-IN)									
	F.S. 178	F.S. 229	F.S. 279	F.S. 321	F.S. 359					
50	89	114	140	161	180					
100	178	229	279	321	359					
150	267	344	419	482	539					
200	356	458	558	642	718					
222	395	508	619	713	797					
250	445	573	698		898					
300	534	687	837							
350	623	802	977							
390	694	893	1,088							
400	712		1,116							
404	719		1,127							
450	801									
500	890									
544	968									

NOTES:

All cargo must be supported by the seat tracks and tied down to the tracks by an FAA-approved method.

Figure 23-13. Useful Load Weight and Moments Usable Fuel (Gallons) (Sheet 1 of 2)

USEFUL LOAD WEIGHTS AND MOMENTS - USABLE FUEL (GALLONS) 6.3 LB/GAL 7.1 LB/GAL 6.5 LB/GAL 6.7 LB/GAL 6.9 LB/GAL GAL WEIGHT MOMENT/100 WEIGHT MOMENT/100 WEIGHT MOMENT/100 WEIGHT MOMENT/100 WEIGHT MOMENT/100

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Figure 23-13. Useful Load Weight and Moments — Usable Fuel (Gallons) (Sheet 2)

USEFUL LOAD WEIGHTS AND MOMENTS - USABLE FUEL (GALLONS) (Continued)

	GAL	6.3 L	.B/GAL		B/GAL		.B/GAL	_	.B/GAL		_B/GAL
	GAL	WEIGHT	MOMENT/100								
	430	2709	5461	2795	5635	2881	5808	2967	5981	3053	6155
	440	2772	5598	2860	5775	2948	5953	3036	6131	3124	6308
	450	2835	5736	2925	5918	3015	6100	3105	6282	3195	6464
	460	2898	5875	2990	6061	3082	6248	3174	6435	3266	6621
	470	2961	6010	3055	6201	3149	6392	3243	6583	3337	6774
	480	3024	6150	3120	6346	3216	6541	3312	6736	3408	6932
	490	3087	6292	3185	6492	3283	6692	3381	6892	3479	7092
	500	3150	6429	3250	6633	3350	6837	3450	7041	3550	7245
	510	3213	6568	3315	6776	3417	6985	3519	7194	3621	7402
	520	3276	6702	3380	6915	3484	7128	3588	7341	3692	7554
	530	3339	6834	3445	7051	3551	7268	3657	7485	3763	7702
	539	3396	6971	3504	7193	3611	7414	3719	7635	3827	7857
	550	3465	7160	3575	7387	3685	7615	3795	7842	3905	8069
	560	3528	7327	3640	7559	3752	7792	3864	8025	3976	8257
	570	3591	7492	3705	7730	3819	7968	3933	8206	4047	8444
	580	3654	7656	3770	7899	3886	8142	4002	8385	4118	8628
	590	3717	7817	3835	8065	3953	8313	4071	8561	4189	8809
	600	3780	7975	3900	8228	4020	8481	4140	8735	4260	8988
	610	3843	8132	3965	8390	4087	8648	4209	8906	4331	9164
_	620	3906	8286	4030	8549	4154	8812	4278	9075	4402	9338
님	630	3969	8438	4095	8706	4221	8974	4347	9242	4473	9510
L	640	4032	8590	4160	8863	4288	9135	4416	9408	4544	9681
5	650	4095	8740	4225	9017	4355	9295	4485	9572	4615	9850
5	660	4158	8889	4290	9171	4422	9453	4554	9736	4686	10018
ב ר	670	4221	9038	4355	9325	4489	9612	4623	9899	4757	10185
EXTENDED KANGE FUEL	680	4284	9186	4420	9477	4556	9769	4692	10060	4828	10352
	690	4347	9332	4485	9628	4623	9925	4761	10221	4899	10517
-	700	4410	9477	4550	9778	4690	10079	4830	10380	4970	10681
ц	710	4473	9619	4615	9924	4757	10230	4899	10535	5041	10841
	720	4536	9760	4680	10070	4824	10379	4968	10689	5112	10999
	730	4599	9899	4745	10213	4891	10527	5037	10842	5183	11156
	740	4662	10034	4810	10352	4958	10671	5106	10989	5254	11308
	750	4725	10166	4875	10489	5025	10811	5175	11134	5325	11457
	760	4788	10296	4940	10623	5092	10949	5244	11276	5396	11603
	770	4851	10422	5005	10753	5159	11084	5313	11415	5467	11746
	775	4883	10485	5038	10818	5192	11151	5348	11483	5503	11816

Figure 23-14. Useful Load Weight and Moments — Usable Fuel (Liters) (Sheet 1 of 2)

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HISEELII LOAD WEIGHTS AND MOMENTS - HSARI E EHEL (LITEDS)

LITERS	.75 K	.75 KG/LITER		.78 KG/LITER		G/LITER	.83 K	G/LITER	.85 KG/LITER	
LITERS	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100
50	38	69	39	71	40	73	42	76	43	78
100	75	137	78	143	80	147	83	152	85	156
150	113	207	117	215	120	221	125	229	128	235
200	150	277	156	288	160	295	166	309	170	314
250	188	349	195	363	200	373	208	387	213	396
300	225	425	234	442	240	453	249	470	255	481
350	263	501	273	521	280	534	291	554	298	568
400	300	577	312	600	320	615	332	638	340	654
450	338	653	351	679	360	696	374	722	383	740
500	375	729	390	758	400	778	415	807	425	827
550	413	806	429	838	440	860	457	892	468	914
600	450	881	468	916	480	939	498	974	510	998
650	488	955	507	993	520	1019	540	1057	553	1082
700	525	1029	546	1070	560	1097	581	1138	595	1166
750	563	1103	585	1147	600	1177	623	1221	638	1250
800	600	1152	624	1229	640	1261	664	1308	680	1339
850	638	1257	663	1308	680	1341	706	1392	723	1425
900	675	1332	702	1386	720	1421	747	1475	765	1510
950	713	1405	741	1462	760	1499	789	1555	808	1593
1000	750	1480	780	1539	800	1579	830	1638	850	1677
1050	788	1554	819	1616	840	1658	872	1720	893	1762
1100	825	1631	858	1696	880	1740	913	1805	935	1848
1150	863	1708	897	1776	920	1822	955	1890	978	1935
1200	900	1784	936	1855	960	1903	996	1974	1020	2022
1250	938	1860	975	1934	1000	1984	1038	2059	1063	2108
1300	975	1936	1014	2014	1040	2065	1079	2143	1105	2195
1350	1013	2013	1053	2094	1080	2148	1121	2228	1148	2282
1400	1050	2093	1092	2176	1120	2232	1162	2316	1190	2372
1450	1088	2172	1131	2259	1160	2317	1204	2404	1233	2462
1500	1125	2253	1170	2343	1200	2403	1245	2493	1275	2553
1550	1163	2335	1209	2428	1240	2490	1287	2584	1318	2646
1600	1200	2416	1248	2513	1280	2578	1328	2674	1360	2739
1650	1238	2498	1287	2598	1320	2664	1370	2764	1403	2831
1700	1275	2580	1326	2683	1360	2752	1411	2855	1445	2924
1750	1313	2662	1365	2769	1400	2840	1453	2946	1488	3017
1800	1350	2744	1404	2854	1440	2927	1494	3037	1530	3110
1850	1388	2828	1443	2941	1480	3017	1536	3130	1573	3205
1900	1425	2910	1482	3027	1520	3104	1577	3221	1615	3298
1950	1463	2992	1521	3111	1560	3191	1619	3311	1658	3391
2000	1500	3071	1560	3194	1600	3276	1660	3398	1700	3480
2040	1530	3141	1591	3267	1632	3351	1693	3476	1734	3560
			1001	0201	1002	0001	1000	3710	1707	

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Figure 23-14. Useful Load Weight and Moments — Usable Fuel (Liters) (Sheet 2)

USEFUL LOAD WEIGHTS AND MOMENTS - USABLE FUEL (LITERS) (Continued)

	LITERS	.75 KG	/LITER	.78 KG/LITER			LITER		/LITER		/LITER
	LITERS	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100	WEIGHT	MOMENT/100
	2100	1575	3262	1638	3393	1680	3480	1743	3610	1785	3697
	2150	1613	3361	1677	3496	1720	3585	1785	3720	1828	3809
	2200	1650	3459	1716	3597	1760	3689	1826	3828	1870	3920
	2250	1688	3554	1755	3696	1800	3791	1868	3933	1913	4028
ب	2300	1725	3648	1794	3794	1840	3891	1909	4037	1955	4134
FUEL	2350	1763	3740	1833	3889	1880	3989	1951	4138	1998	4238
Ш	2400	1800	3830	1872	3983	1920	4086	1992	4239	2040	4341
RANGE	2450	1838	3920	1911	4077	1960	4181	2034	4338	2083	4442
ゑ	2500	1875	4009	1950	4169	2000	4276	2075	4436	2125	4543
	2550	1913	4097	1989	4261	2040	4370	2117	4534	2168	4643
EXTENDED	2600	1950	4185	2028	4352	2080	4464	2158	4631	2210	4743
핆	2650	1988	4271	2067	4442	2120	4556	2200	4727	2253	4841
×	2700	2025	4356	2106	4530	2160	4646	2241	4820	2295	4937
ш	2750	2063	4439	2145	4617	2200	4735	2283	4913	2338	5031
	2800	2100	4520	2184	4701	2240	4822	2324	5002	2380	5123
	2850	2138	4599	2223	4783	2280	4905	2366	5089	2423	5212
	2900	2175	4675	2262	4862	2320	4987	2407	5174	2465	5299
	2934	2201	4726	2289	4916	2347	5042	2435	5232	2494	5357

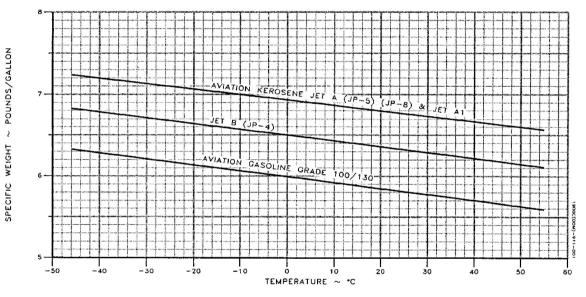
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Figure 23-15. Density Variation of Aviation Fuel

DENSITY VARIATION OF AVIATION FUEL BASED ON AVERAGE SPECIFIC GRAVITY

FUEL	AVERAGE SPECIFIC GRAVITY
JET A (JP-5) (JP-8) AND JET A1	.819 AT 15°C
JET B (JP-4)	.764 AT 15°C
AV GAS GRADE 100/130	.706 AT 15°C



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Figure 23-16. Unusable Fuel (Pounds/Kilograms)

UNUSABLE FUEL (POUNDS/KILOGRAMS)									
	WEI	WEIGHT		MON	IENT				
ITEM	(lb)	(kg)	F.S.(in)	(lb-in.)	(kg-in.)				
*Trapped/Undrainable									
Wing, Nacelle, and Aux Fuel Tank	10	4		2,073	1,037				
Extended Range Fuel Tank	2	1		306	139				
*Trapped/Undrainable — Total	12	5		2,379	1,176				
*Drainable									
Wing, Nacelle, and Aux Fuel Tank	42	19		7,412	3,341				
Extended Range Fuel Tank	6	3		1,729	784				
*Drainable — Total	48	22		9,141	4,125				
*Total per aircraft with fuel density of 6.7 lb/gal ((.8 kg/liter)								

Figure 23-17. Engine Oil (Pounds/Kilograms)

ENGINE OIL (POUNDS/KILOGRAMS)							
ITEM	WEIGHT		ARM	MOMENT			
	(lb)	(kg)	F.S.(in)	(lb-in.)	(kg-in.)		
Full Tanks	57	26		7,547	3,442		

23.3 LOADING INSTRUCTIONS

It is the responsibility of the airplane operator to ensure that the airplane is properly loaded. At the time of delivery, Hawker Beechcraft Corporation provides the necessary weight and balance to compute the individual loadings. All subsequent changes in airplane weight and balance are the responsibility of the airplane owner and/or operator.

The basic empty weight and moment of the airplane at the time of delivery are shown on the Basic Empty Weight and Balance form. Useful load items which may be loaded into the airplane are shown on the Useful Load Weights and Moments tables. The minimum and maximum moments approved by the FAA are shown on the Moment Limits vs. Weight graph or table. These moments correspond to the forward and aft center of gravity flight limits (landing gear down) for a particular weight. All moments are divided by 100 to simplify computations.

23.4 CARGO LOADING

The method of loading cargo, its placement in the airplane and the method of restraint should each be determined before starting the actual loading.

For loads that are evenly distributed in a given section, the Useful Load Weights and Moments — Cargo tables should be used. For any load that cannot be located at the centroid of a section or that extends over more than one section, it will be necessary to determine its own CG and its location in the airplane. Determine the CG arm (Fuselage Station) by measuring in inches, from a known location in the cabin to the CG of the load. Determine the "moment" for the load by multiplying the weight by the CG arm (Fuselage Station). This moment should be divided by 100 to be compatible with other loading data.

23.5 COMPUTING PROCEDURE

1. Record the basic empty weight and moment from the Basic Empty Weight and Balance form (or from the latest superseding forms). The moment must be divided by 100 to correspond to the Useful Load Weight and Moments tables.

- 2. Record the weight and corresponding moment/100 of each item to be carried. These values are found in the Useful Load Weights and Moments tables.
- 3. Subtotal the weight column and moment column. The weight without usable fuel must not exceed the Maximum Zero Fuel Weight limitation of 13,000 pounds. All weight in excess of this limitation must be fuel.
- 4. Enter the fuel weight and moment/100 from the Useful Load Weights and Moments Usable Fuel table. Subtotal the weight column and moment column and check to ensure the weight and moment are within the Ramp Weight limits.
- 5. Subtract the start, taxi, and take-off fuel weight and moment/100 (which is normally 100 pounds at an average moment/100 of 227 pound-inches) to determine the take-off weight and moment. Check to ensure the weight and moment does not exceed the Maximum Take-off limits.
- 6. Determine the landing weight by completing lines 23 through 27 on the loading form, refer to Figure 23-35.

Figure 23-18. Weight and Balance Loading Form

WEIGHT AND BALANCE LOADING FORM

SERIAL							
LINE	ITEM	WEIGHT *()	F.S. (IN)	MOM/100 *()			
1	Basic Empty Weight						
2	Pilot						
3	Copilot						
4	Passenger 1 or Cargo in Section A						
5	Passenger 2 or Cargo in Section B						
6	Passenger 3 or Cargo in Section C						
7	Passenger 4 or Cargo in Section D						
8	Passenger 5 or Cargo in Section E						
9	Passenger 6						
10	Passenger 7						
11	Passenger 8						
12	Passenger 9						
13	Passenger 10						
14	Total Cabinet Contents						
15	Baggage						
16	Baggage						
17	Baggage						
18	Subtotal — Zero Fuel Weight DO NOT EXCEED 13,000 LBS. (5897 Kg)						
19	Fuel Loading						
20	Subtotal — Ramp Weight DO NOT EXCEED 16,600 LBS. (7530 Kg)						
21	Less Fuel for Start, Taxi, and Takeoff**						
22	Total — Take-Off Weight DO NOT EXCEED 16,500 LBS. (7484 Kg)						
* Enter u	inits used. Lbs and Lb-In. or Kg and Kg-In.						
** Fuel fo (103 Kg-	or Start, Taxi and Takeoff is normally 100 lbs (45 kg) at an avoiln.).	erage moment/	100 of 227 LI	o-In.			
	LANDING WEIGHT DETERMINA	ATION					
23	Fuel Loading from Line 19						
24	Less Fuel used to Destination (Including fuel for start, taxi and takeoff)						
25	Total Fuel Remaining Moment/100 from Usable Fuel Weights and Moments Table						
26	Zero Fuel Weight from Line 18						
27	Total Landing Weight (lines 25 + 26)						

23-19

Shaded areas in the above tables indicate values that are not required to arrive at a final weight and balance.



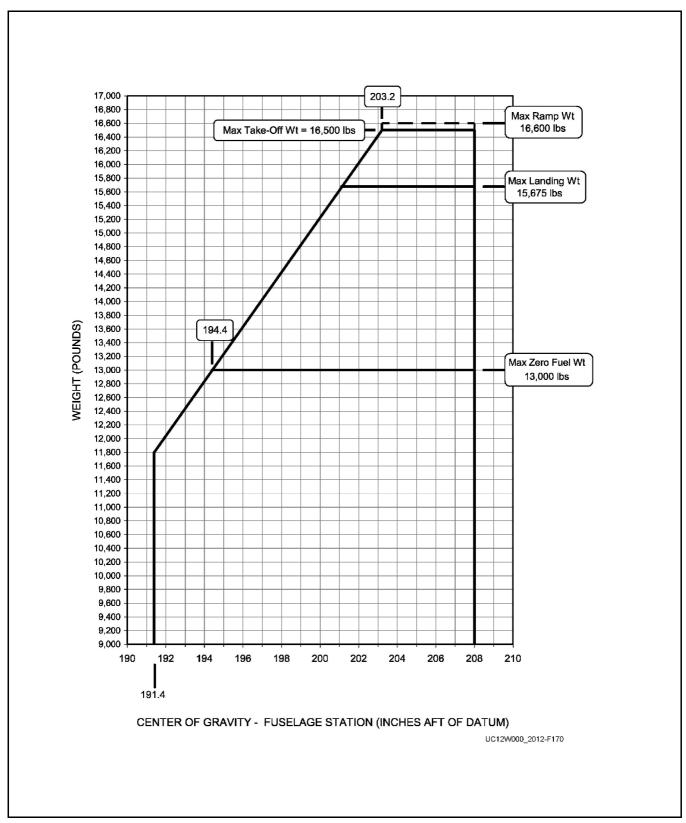


Figure 23-20. Weight and Balance Diagram (Kilograms)

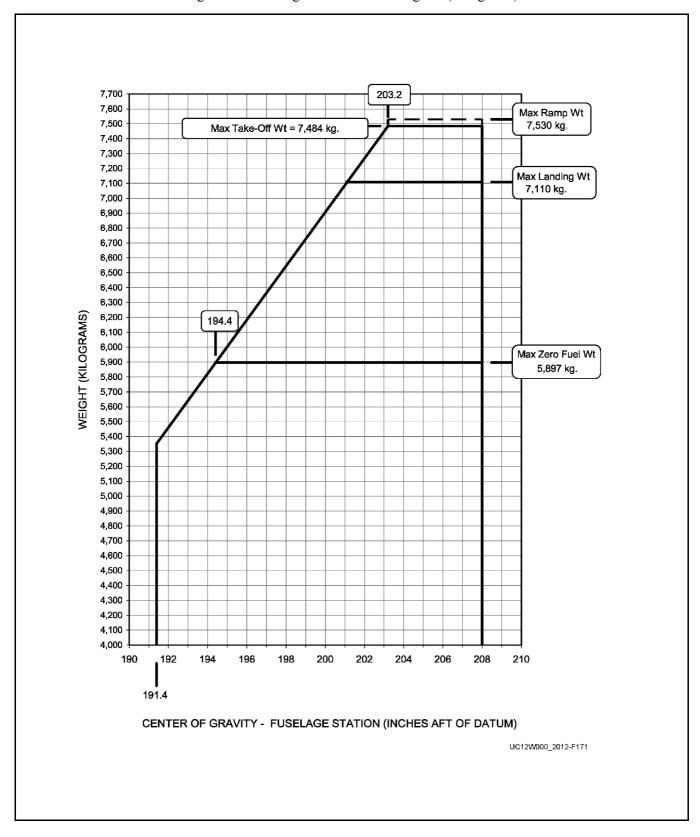


Figure 23-21. Moment Limits vs Weight (Pounds)

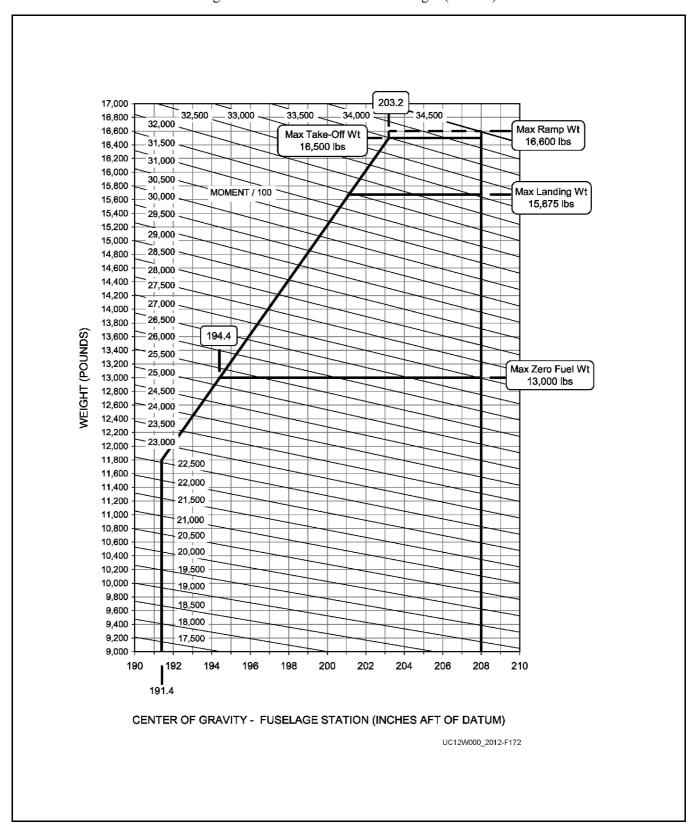


Figure 23-22. Moment Limits vs Weight (Kilograms)

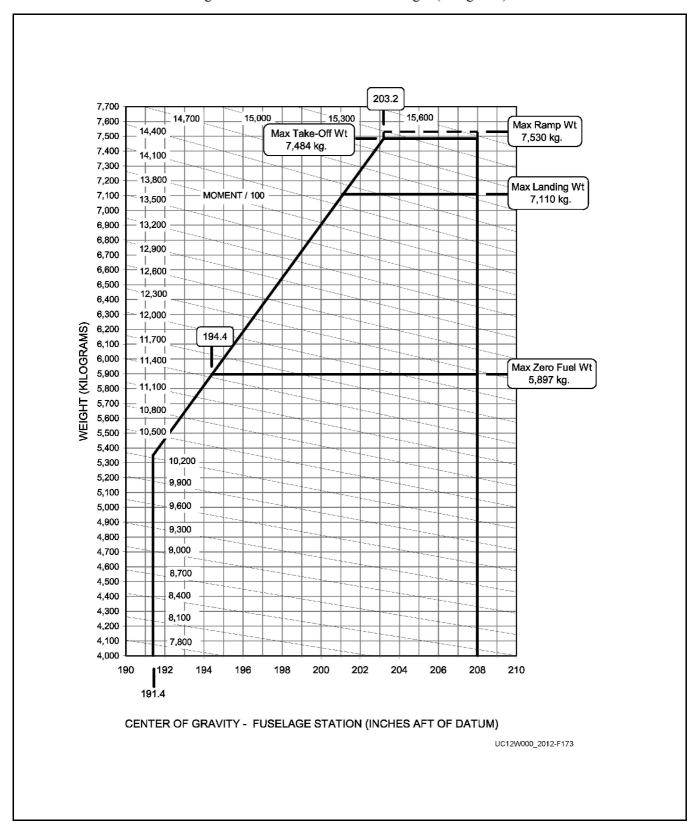


Figure 23-23. Moment Limits vs Weight (Sheet 1 of 2)

MOMENT LIMITS VS WEIGHTS

	MINIMUM MOMENT/100	MAXIMUM MOMENT/100		MINIMUM MOMENT/100	MAXIMUM MOMENT/100
WEIGHT (LB)	(LB-IN)	(LB-IN)	WEIGHT (KG)	(KG-IN)	(KG-IN)
9000	17226	18720	4000	7656	8320
9100	17417	18928	4050	7752	8424
9200	17609	19136	4100	7847	8528
9300	17800	19344	4150	7943	8632
9400	17992	19552	4200	8039	8736
9500	18183	19760	4250	8135	8840
9600	18374	19968	4300	8230	8944
9700	18566	20176	4350	8326	9048
9800	18757	20384	4400	8422	9152
9900	18949	20592	4450	8517	9256
10000	19140	20800	4500	8613	9360
10100	19331	21008	4550	8709	9464
10200	19523	21216	4600	8804	9568
10300	19714	21424	4650	8900	9672
10400	19906	21632	4700	8996	9776
10500	20097	21840	4750	9092	9880
10600	20288	22048	4800	9187	9984
10700	20480	22256	4850	9283	10088
10800	20671	22464	4900	9379	10192
10900	20863	22672	4950	9474	10296
11000	21054	22880	5000	9570	10400
11100	21245	23088	5050	9666	10504
11200	21437	23296	5100	9761	10608
11300	21628	23504	5150	9857	10712
11400	21820	23712	5200	9953	10816
11500	22011	23920	5250	10049	10920
11600	22202	24128	5300	10144	11024
11700	22394	24336	5350	10240	11128
11800	22585	24544	5352	10244	11132
11900	22800	24752	5400	10352	11232
12000	23028	24960	5450	10459	11336
12100	23250	25168	5500	10571	11440
12200	23473	25376	5550	10684	11544
12300	23702	25584	5600	10797	11648
12400	23920	25792	5650	10905	11752
12500	24150	26000	5700	11018	11856
12600	24368	26208	5750	11132	11960
12700	24600	26416	5800	11246	12064
12800	24819	26624	5850	11355	12168

Figure 23-23. Moment Limits vs Weight (Sheet 2)

MOMENT LIMITS VS WEIGHTS

WEIGHT (LB)	MINIMUM MOMENT/100 (LB-IN)	MAXIMUM MOMENT/100 (LB-IN)	WEIGHT (KG)	MINIMUM MOMENT/100 (KG-IN)	MAXIMUM MOMENT/100 (KG-IN)
12900	25052	26832	5897	11464	12266
13000	25272	27040	5900	11470	12272
13100	25506	27248	5950	11585	12376
13200	25727	27456	6000	11700	12480
13300	25962	27664	6050	11816	12584
13400	26184	27872	6100	11926	12688
13500	26420	28080	6150	12042	12792
13600	26642	28288	6200	12158	12896
13700	26879	28496	6250	12275	13000
13800	27103	28704	6300	12386	13104
13900	27341	28912	6350	12503	13208
14000	27566	29120	6400	12621	13312
14100	27805	29328	6450	12739	13416
14200	28031	29536	6500	12851	13520
14300	28271	29744	6550	12969	13624
14400	28498	29952	6600	13088	13728
14500	28739	30160	6650	13207	13832
14600	28966	30368	6700	13326	13936
14700	29209	30576	6750	13439	14040
14800	29437	30784	6800	13559	14144
14900	29681	30992	6850	13679	14248
15000	29910	31200	6900	13800	14352
15100	30155	31408	6950	13914	14456
15200	30385	31616	7000	14035	14560
15300	30631	31824	7050	14156	14664
15400	30862	32032	7100	14278	14768
15500	31109	32240	7110	14298	14789
15600	31340	32448	7150	14393	14872
15675	31522	32604	7200	14515	14976
15700	31588	32656	7250	14638	15080
15800	31821	32864	7300	14761	15184
15900	32070	33072	7350	14884	15288
16000	32304	33280	7400	15000	15392
16100	32554	33488	7450	15124	15496
16200	32789	33696	7484	15207	15567
16300	33040	33904	7530	15301	15662
16400	33276	34112			
16500	33528	34320			
16600	33731	34528			

23.6 CENTER OF GRAVITY LIMITS (LANDING GEAR DOWN)

Figure 23-24. Center Of Gravity Limits (Landing Gear Down)

WEIGHT CONDITION	FORWARD C.G. LIMIT (IN)	AFT C.G. LIMIT (IN)
16,500 LB (7,484 KG) (MAXIMUM TAKEOFF)	203.2	208.0
15,675 LB (7,110 KG) (MAXIMUM LANDING)	201.2	208.0
11,800 LB (5,352 KG) OR LESS	191.4	208.0

23.7 HAZARDOUS MATERIALS

It is essential to prevent the escape of residual fluid from hydraulic actuators, pumps, fuel control units, etc. Aircrew shall ensure all fluid ports, vents, and lines are sealed with plugs or caps as appropriate before air shipments.

Note

Handling and transporting of chemicals, explosives, and other types of dangerous cargo in military aircraft requires special instructions. These specialized instructions are contained in NAVSUPPUB 505, Preparation of Hazardous Materials for Military Air Shipment. Handling of dangerous cargo identified in NAVSUPPUB 505 shall be rigidly enforced.

23.8 CARGO FLOOR CARGO EQUIPMENT

23.8.1 General

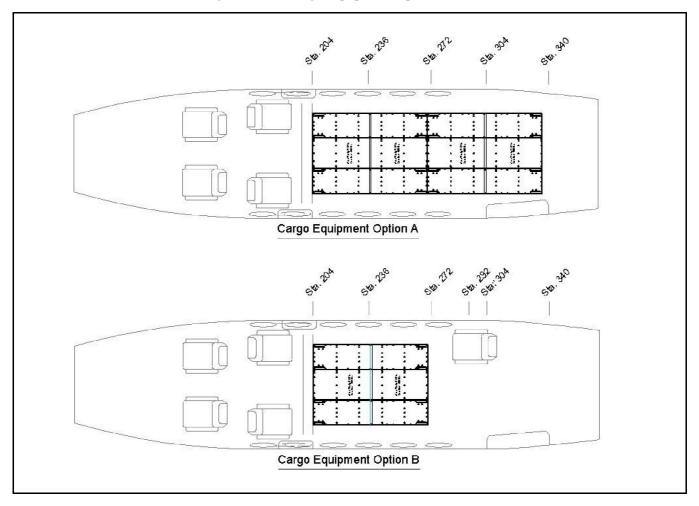
The following contains special instructions for aircraft with Aerospace Resources cargo equipment installed. The cargo equipment will allow for general cargo to be secured on cargo decks attached to the existing seat track. Four optional locations for the cargo equipment to be installed are available. Cargo Equipment Option A and Option B locations in the cabin are shown in Figure 23-25.

Cargo Equipment Option A has four sections and each can secure up to 400 lbs for a maximum of 1,600 lbs of cargo in the cabin. Cargo Equipment Option B has two sections and each can secure up to 400 lbs for a maximum of 800 lbs of cargo in the cabin.

Cargo Equipment Option C and Option D locations in the cabin are shown in Figure 23-26.

Cargo Equipment Option C and D each have two sections and can secure up to 400 lbs per section for a maximum of 800 lbs of cargo in the cabin.

Figure 23-25. Cargo Equipment Options A and B



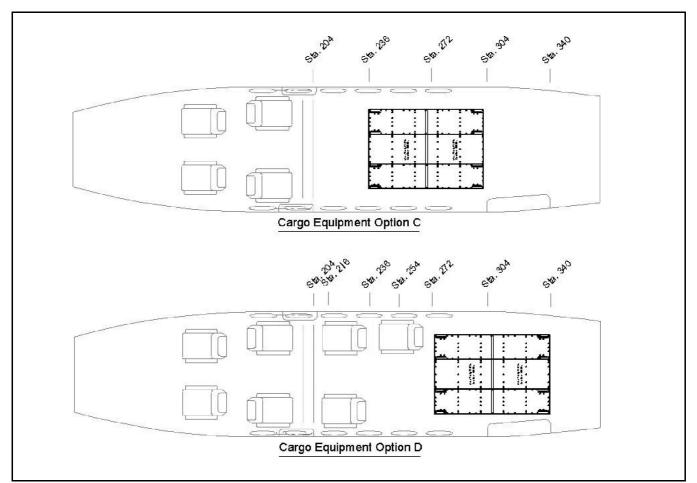


Figure 23-26. Cargo Equipment Options C and D

23.8.2 Systems Description

The cargo equipment consists of one or two cargo decks on each existing seat rail and one or two decks in the cabin center to create a flat floor to secure cargo. Each set of decks is divided into two sections. Each deck section can support up to 400 pounds of cargo. There are four Cargo Equipment Options, A, B, C and D. A cargo net assembly is included with the modification to restrain the cargo. The cargo must be secured such that there is a clear and unobstructed egress path to at least one emergency or normal exit on each side of the aircraft in the event of either a normal or emergency landing. Ensure that the emergency and normal exits are readily accessible in the event that the cargo shifts during any flight operation. The existing seating in the cabin not at the cargo equipment stations is optional and can remain installed or be removed, as required. Figure 23-25 and Figure 23-26 depict the only authorized seating configurations with the cargo equipment installed. Any combination of installed or removed seating is allowable within the respective cargo equipment option.

For Cargo Equipment Option A, the hooks on the ends of the cargo net must be inserted into the four slots in the forward end, two slots on each side and four slots in the aft end of the cargo deck. The four side straps and four aft straps of the cargo net each have a ratchet to tighten the net around the cargo. Below each cargo deck slot is a rod that the hook secures to. The retainer latch on the cargo hook must engage the cargo deck rod. Refer to Figure 23-27.

For Cargo Equipment Options B, C and D, the hooks on the ends of the cargo net must be inserted into the four slots in the forward end and four slots in the aft end of the cargo deck. The aft four straps of the cargo net each have a ratchet to tighten the net around the cargo. The four straps used on the side slots for Cargo Equipment Option A are not used with Cargo Equipment Options B, C and D and the straps should be removed and stored for future use. Below each cargo deck slot is a rod that the hook secures to. The retainer latch on the cargo hook must engage the cargo deck rod. Refer to Figure 23-27.

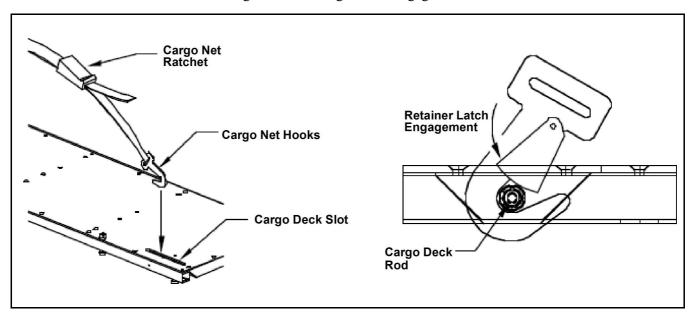
23.8.3 Limitations

- 1. The maximum weight of cargo in any section is 400 pounds.
- 2. The maximum total weight of cargo secured to Cargo Equipment Option A is 1,600 pounds.
- 3. The maximum total weight of cargo secured to Cargo Equipment Option B, C or D is 800 pounds.
- 4. The maximum concentrated weight of cargo is 100 pounds per square foot.
- 5. Do not obstruct existing fire extinguisher, life raft or any other cabin safety items with loaded cargo or cargo net.
- 6. Loaded cargo must remain inboard of the row of cargo deck slots for the cargo net hooks in the cargo deck panel on the side with the aircraft door. This is to allow egress and room to operate the normal exit door.

WARNING

The loaded cargo must be secured such that there is a clear and unobstructed egress path to at least one emergency or normal exit on each side of the aircraft in the event of either a normal or emergency landing. The operator must ensure that the emergency and normal exits are readily accessible in the event that the cargo shifts during any flight operation.

Figure 23-27. Cargo Hook Engagement



23.8.3.1 Placards

The following placards are installed on the Cargo Equipment. Refer to Figures 23-28 thru 23-30.

Figure 23-28. Placarded On Each Center Cargo Deck

Max. Weight this Section 400 lbs

Figure 23-29. Placarded On Aft End Of Center Cargo Deck

Maximum Load Concentration 100 lbs per square foot

Figure 23-30. Placarded On Both Ends Of The Outboard Cargo Decks

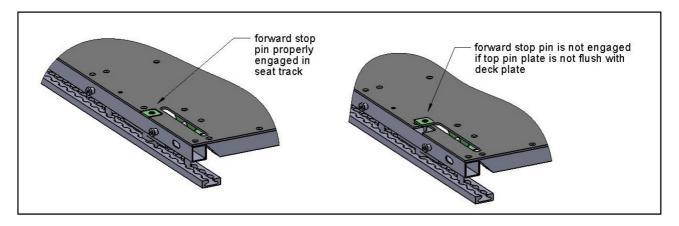
WARNING

There must be at least one emergency exit on each side of the aircraft accessible to the crew and occupants

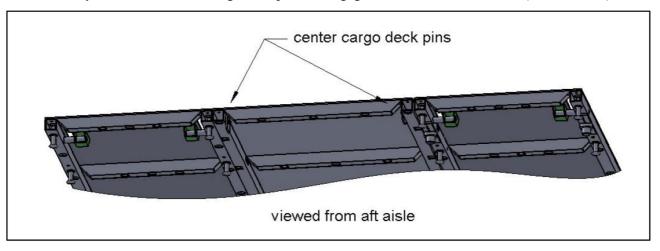
23.8.4 Normal Procedures

In addition to the standard preflight inspection:

- 1. Verify that the aircraft empty weight and balance has been updated for the cargo modification.
- 2. Verify that the installed location of the cargo equipment corresponds with the Cargo Equipment Option stations, as shown in Figures 23-25 and 23-26.
- 3. Visually inspect that the four forward stop pins are engaging the aircraft seat track. When the forward stop pins are properly engaged, the pin plate will be flush with the cargo deck top as shown below:



4. Verify that the two center cargo deck pins are engaged into two outboard decks (shown below):



- 5. Ensure that all cargo is properly secured and the aircraft loaded weight and CG is within limits.
- 6. Verify that the cargo is secured such that there is a clear and unobstructed egress path to at least one emergency or normal exit on each side of the aircraft in the event of either a normal or emergency landing. Ensure that the emergency and normal exits are readily accessible in the event that the cargo shifts during any flight operation.

23.8.5 Weight and Balance

23.8.5.1 Cargo Equipment Option A

Verify that the aircraft empty weight and balance has been updated for the addition of the cargo equipment. The remaining seats and the aft cargo area station and load limitations remain unchanged. Refer to Chapter 23 for station number and locations for existing components. The station for the cargo in Cargo Equipment Option A is shown in Figure 23-31. The corresponding cargo weights and moments are shown in Figure 23-32.

Figure 23-31. Cargo Equipment Option A

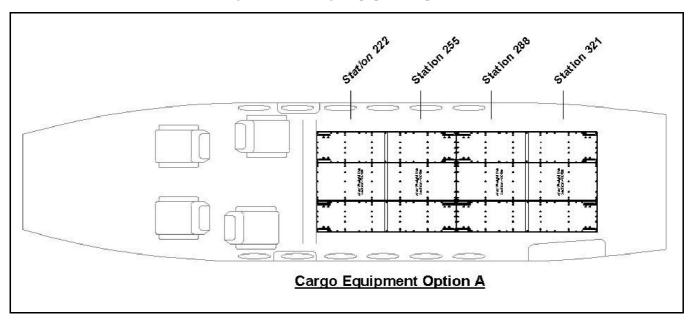


Figure 23-32. Cargo Weights and Moments - Cargo Equipment Option A

CARGO EQUIPMENT OPTION A				
	FORWARD SECTION	SECOND SECTION	THIRD SECTION	AFT SECTION
WEIGHT	STATION 222	STATION 255	STATION 288	STATION 321
(POUNDS)	N	MOMENT/100 (F	OUND INCHES	5)
20	44	51	58	64
40	89	102	91	128
60	133	153	173	193
80	178	204	230	257
100	222	255	288	321
120	266	306	346	385
140	311	357	403	449
160	355	408	461	514
180	400	459	518	578
200	444	510	576	642
220	488	561	634	706
240	533	612	691	770
260	577	663	749	835
280	622	714	806	899
300	666	765	864	963
320	710	816	922	1,027
340	755	867	979	1,091
360	800	918	1,037	1,156
380	844	969	1,094	1,212
400	888	1,020	1,152	1,284

23.8.5.2 Cargo Equipment Option B

Verify that the aircraft empty weight and balance has been updated for the addition of the cargo equipment. The remaining seats and the aft cargo area station and load limitations remain unchanged. Refer to Chapter 23 for station number and locations for existing components. The station for the cargo in Cargo Equipment Option B is shown in Figure 23-33. The corresponding cargo weights and moments are shown in Figure 23-34.

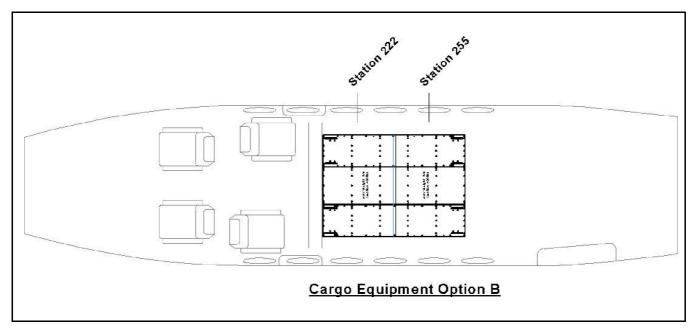


Figure 23-33. Cargo Equipment Option B

Figure 23-34. Cargo Weights and Moments - Cargo Equipment Option B

CARGO EQUIPMENT OPTION B				
	FORWARD SECTION	AFT SECTION		
WEIGHT	STATION 222	STATION 255		
(POUNDS)	MOMENT/100 (F	POUND INCHES)		
20	44	51		
40	89	102		
60	133	153		
80	178	204		
100	222	255		
120	266	306		
140	311	357		
160	355	408		
180	400	559		
200	444	510		
220	488	561		
240	533	612		
260	577	663		
280	622	714		
300	666	765		

Figure 23-34. Carg	o Weights and Moments -	Cargo Equi	ipment Option B	(cont.)

CARGO EQUIPMENT OPTION B					
FORWARD SECTION AFT SECTION					
WEIGHT	STATION 222	STATION 255			
(POUNDS)	MOMENT/100 (POUND INCHES)				
320	710	816			
340	755	867			
360	800	918			
380	844	969			
400	888	1,020			

23.8.5.3 Cargo Equipment Option C

Verify that the aircraft empty weight and balance has been updated for the addition of the cargo equipment. The remaining seats and the aft cargo area station and load limitations remain unchanged. Refer to Chapter 23 for station number and locations for existing components. The station for the cargo in Cargo Equipment Option C is shown in Figure 23-35. The corresponding cargo weights and moments are shown in Figure 23-36.

Figure 23-35. Cargo Equipment Option C

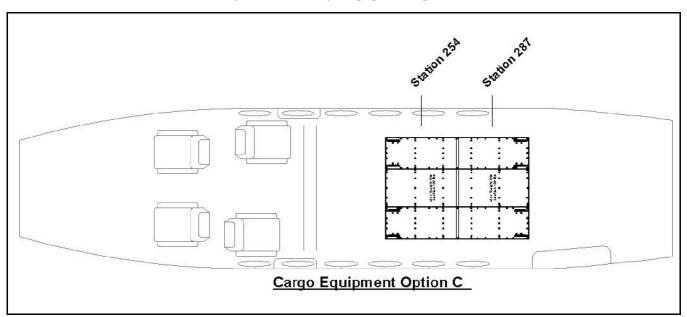


Figure 23-36. Cargo Weights and Moments - Cargo Equipment Option C

CARGO EQUIPMENT OPTION C					
FORWARD SECTION AFT SECTION					
WEIGHT	STATION 254	STATION 287			
(POUNDS)	MOMENT/100 (POUND INCHES)				
20	51	57			
40	102	115			
60	152	172			

Figure 23-36, Cargo	Weights and Moments	- Cargo Equipmen	t Option C (co	ont.)

CARGO EQUIPMENT OPTION C				
	FORWARD SECTION	AFT SECTION		
WEIGHT	STATION 254	STATION 287		
(POUNDS)	MOMENT/100 (F	POUND INCHES)		
80	203	230		
100	254	287		
120	305	344		
140	356	402		
160	406	459		
180	457	517		
200	508	574		
220	559	631		
240	610	689		
260	660	746		
280	711	804		
300	762	861		
320	813	918		
340	864	976		
360	914	1,033		
380	965	1,091		
400	1,016	1,148		

23.8.5.4 Cargo Equipment Option D

Verify that the aircraft empty weight and balance has been updated for the addition of the cargo equipment. The remaining seats and the aft cargo area station and load limitations remain unchanged. Refer to Chapter 23 for station number and locations for existing components. The station for the cargo in Cargo Equipment Option D is shown in Figure 23-37. The corresponding cargo weights and moments are shown in Figure 23-38.

Figure 23-37. Cargo Equipment Option D

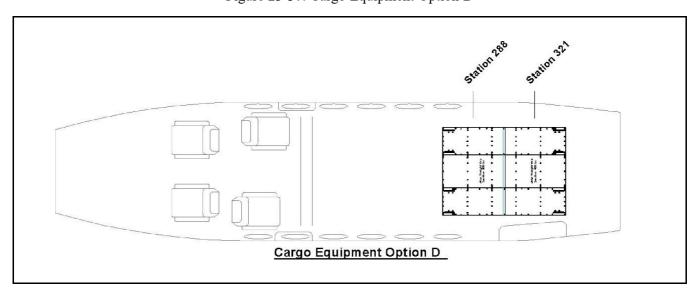


Figure 23-38. Cargo Weights and Moments - Cargo Equipment Option D

CARGO EQUIPMENT OPTION D				
	FORWARD SECTION	AFT SECTION		
WEIGHT	STATION 288	STATION 321		
(POUNDS)	MOMENT/100 (P	OUNDS INCHES)		
20	58	64		
40	91	128		
60	173	193		
80	230	257		
100	288	321		
120	346	385		
140	403	449		
160	461	514		
180	518	578		
200	576	642		
220	634	706		
240	691	770		
260	749	835		
280	806	899		
300	864	963		
320	922	1,027		
340	979	1,091		
360	1,037	1,156		
380	1,094	1,212		
400	1,152	1,284		

23.9 OTHER LIMITATIONS

23.9.1 Cargo Limitations

23.9.1.1 General Cargo Limitations

- 1. All cargo shall be properly secured by an FAA-approved cargo restraint system.
- 2. Cargo shall be arranged to permit free access to all exits and emergency exits.

23.9.1.2 Cargo Floor Cargo Equipment Limitations

- 1. The maximum weight of cargo in any section is 400 pounds.
- 2. The maximum total weight of cargo secured to Cargo Equipment Option A is 1,600 pounds.
- 3. The maximum total weight of cargo secured to Cargo Equipment Option B, C or D is 800 pounds.
- 4. The maximum concentrated weight of cargo is 100 pounds per square foot.
- 5. Do not obstruct existing fire extinguisher, life raft or any other cabin safety items with loaded cargo or cargo net.

6. Loaded cargo must remain inboard of the row cargo deck slots for the cargo net hooks in the cargo deck panel on the side with the aircraft door. This is to allow egress and room to operate the normal exit door.

WARNING

The loaded cargo must be secured such that there is a clear and unobstructed egress path to at least one emergency or normal exit on each side of the aircraft in the event of either a normal or emergency landing. The operator must ensure that the emergency and normal exits are readily accessible in the event that the cargo shifts during any flight operation.

APPENDIX A

AN/ALE-47 Countermeasures Dispensing Set Mission Data File 2763 and 2764

A.1 MISSION DATA FILE (MDF) 2763 AND 2764

MDF 2763 and 2764 are an operational MDF. The MDF provides mission critical and platform specific data to the ALE-47(V) Programmer. MDF 2763 and 2764 are compatible with Programmer Operational Flight Program (OFP) version 1136. MDF 2763 is compatible with Sequencer OFP version 3052. MDF 2764 is compatible with Programmer OFP version 1137 and Sequencer OFP version 3053. The UC-12W AN/ALE-47(V) installation configuration is depicted in Figure A-1.

Figure A-1. UC-12W AN/ALE-47 Installation Configuration

QUANTITY	ITEM DESCRIPTION	ITEM NOMENCLATURE	PART NUMBER
1	CD-45(V)1	ALE-47(V) Programmer	179730-0006
2	SA-2669	Sequencer	179250-0003
3	D-66	Dispenser Assembly	3268AS500-001
1	C-12170	Control Display Unit	179740-0002

A.2 MISSION DATA FILE (MDF) 2763 AND 2764 MAGAZINE LOADOUT

MDF 2763 Magazine Loadout is depicted in Figure A-2.

Figure A-2. Mission Data File (MDF) 2763 and 2764 Magazine Loadout

MAG ID SWITCH SETTINGS	MAGAZINE ID NUMBER	TYPE OTHER 1	QTY	TYPE OTHER 2	QTY	TYPE CHAFF	QTY	TYPE FLARE	QTY
A1*	15*	TEST_O1	7	TEST_O2	7	TEST_CH	7	TEST_FL	9
A2**	13	MJU-57	30						
А3	14							MJU-32	30
A4	12			MJU-49	30				
B1	07			MJU-49	15			MJU-32	15
B2**	05	MJU-57	12	MJU-49	12			MJU-32	6
B3**	06	MJU-57	9	MJU-49	14			MJU-32	7
B4**	04	MJU-57	6	MJU-49	16			MJU-32	8
C1	11				Not l	Jsed			
C2	09			MJU-49	24			MJU-32	6
C3	10			MJU-49	21			MJU-32	9

Figure A-2. Mission Data File (MDF) 2763 and 2764 Magazine Loadout (cont.)

MAG ID SWITCH SETTINGS	MAGAZINE ID NUMBER	TYPE OTHER 1	QTY	TYPE OTHER 2	QTY	TYPE CHAFF	QTY	TYPE FLARE	QTY
C4	08								
D1	03				Not l	Jsed			
D2	01								
D3	02			MJU-49	18			MJU-32	12
D4	00				Not l	Jsed			

^{*} Magazine ID Switch Setting A1 is for maintenance purposes only.

TEST_XX expendable types are programmed to support O-Level checkout of the ALE-47 using the ALM-286 or ALM-290 with switches set to A1. All TEST_XX expendables can be jettisoned.

Dispensing with Breechplate Switches set to A1 is impossible (except for Bypass and Jettison) unless the ALE-47 is in System Checkout Mode.

A.3 MWS DISPENSE PROGRAM

When mapped through countermeasures response optimization (CRO), MWS Discrete Program 3 is configured to dispense programs dependent on the CDU manual program selection switch setting. MWS Discrete Program 3 is configured as depicted in Figure A-3.

Figure A-3. MWS Program Configuration

CDU MANUAL PROGRAM SELECTED	PROGRAM DISPENSED
1	Manual Program 1
2	Manual Program 1
3	Manual Program 3
4	Manual Program 1

^{**} Magazine ID Switch Settings A2, B2, B3, and B4 are for use in the forward firing dispenser only and are not intended for the two side dispensers.

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